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A Study of Association between Accounting Manipulations and Bankruptcy Likelihood

Analysis of 18 public companies from the United Kingdom

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Bachelor's thesis

November 2017

School of Business

Bachelor's Degree Programme in International Business

Jyväskylän ammattikorkeakoulu

JAMK University of Applied Sciences

jamk.fi

Description

Author(s) Gusarova, Mariia Shevtsov, Yaroslav	Type of publication Bachelor's thesis	Date November 2017
		Language of publication: English
	Number of pages 83	Permission for web publication: yes

Title of publication

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Supervisor(s)
Hundal, Shabnamjit

Assigned by
JAMK University of Applied Sciences

The primary objective of this research is to define whether there is any dependence of the probability of bankruptcy on the accounting manipulations. The researchers also tried to identify where the risk of the bankruptcy is coming from – from the market or a firm's internal problems. In addition to that, the research aims to check whether the companies who poorly perform on the stock market are more likely to be manipulators.

The 18 companies from the United Kingdom have been analysed based on relationships between the Altman Z-score model, Beneish M-score model, beta and the standard deviation of the stock prices. The studied period is from 2010 to 2015.

The results show that the probability of bankruptcy does not depend on the accounting manipulations. The risk that causes the bankruptcy probability is coming from the company's management rather than from the market. Whereas according to the findings, the more is the internal risks, the more is the extent of the accounting manipulations.

Researchers have also found, that the high-performing companies are less tend to manipulate than the well-performers and low-performers. No evidence found that the low-performing companies are more manipulative than well-performers. Finally, the findings suggest, that the retail industry is the most robust one regarding the likelihood of bankruptcy.

Keywords/tags (subjects)
Accounting manipulations, bankruptcy, Beneish M-score, Altman Z-score, beta, standard deviation

Misccellanous 11 pages of Appendixes (pp. 91-102) with the calculations and excel spreadsheets with data from the companies' reports.

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1 Introduction

1.1 Background

The idea for this research has been generated from the old story of the Enron enterprise that had happened in 2001. The managers of Enron have managed to create an image of an ultimate company, and their shares raised twice as they had been in the beginning. However, in one year it was found that this image had been a product of carefully fabricated accounts.

It has been found that the investor's behaviour sometimes can be emotionally driven. This factor may affect the cost of company's capital and its stock position on the market. Small and yet unprofitable firms that do not pay dividends can be negatively affected by the emotional predisposition. (Baker, Wurgler 2007, 6) On the other hand, the big multinationals are considered as a less risky security.

As Nassim Taleb has stated in his works, these days, the society goes through the time of high uncertainty. It means that things that might look reliable right now can turn into the most dangerous and hopeless fields in two days or less, just as it happened to a real estate market in 2008, for instance. (2010, 20)

The primary hypothesis of the research is that any company can apply accounting manipulations, even the eldest and robust. On the other hand, small firms from the technology sector might use it to attract the investor's attention and raise funding. In any case, applying any manipulations means that the management is hiding some company's internal problems and this can cause the insolvency of the company.

For example, directors are likely to channel their efforts to embrace debt financing at a low cost, which is an excellent motivation for accounting manipulations. (Dechhow, Sloan, Sweeney 1996) However, boosting the share price by covering existing problems might lead to further financial problems.

This research focuses on investigating relations between accounting manipulations and the probability of bankruptcy and whether there are any. In addition to this, the sources of risk will be studied in order to see the dependence of riskiness of the company and the extent of accounting manipulations.

1.2 Relevance

The work is first and foremost relevant to the existing academic literature. The purpose of this research is an exploratory study, as its' aim is to bring new evidence on the empirical study of bankruptcy and assessing it from different points of view, like a dependent on accounting manipulations, systematic and unsystematic risk.

The main innovation of this work is that both of the problems, manipulations and bankruptcy, have been well studied, but never analysed together. The accounting manipulations have been investigated from the ethics point of view and their causes, but not from the position of the riskiness of a financial asset if it had been artificially changed.

The second application of the work is to try a new method for assessing the financial health of a company. Even though there are many financial analysis reviews on the company's performance with advisory information on whether to invest or not in the enterprise, it has been found, that the simple earnings per share ratio is more accurate than their forecasts (Bradshaw, Drake, Myers and Myers 2009, 16).

1.3 Research questions and objectives

The central question researchers seek an answer for in this work is whether there is a dependence of bankruptcy on the accounting manipulations.

In order to answer it, the analysis of 18 public companies from the United Kingdom is to be undertaken. The researchers will compare the fluctuations of Altman Z-score and Beneish M-score: one is indicating the probability of bankruptcy, and the other detects the extent of accounting manipulations.

The objective of the study is to find the correlation between Altman's and Beneish's score. It is the central goal of this research. Other objectives and questions are secondary, but ad to the overall understanding of the problem.

The second question concerns the nature of risks company is facing. Initially, there are two types of risks – factors that the management cannot control (systematic risk) and the internal problems of the company (unsystematic risk).

1) What type of risk affects the probability of bankruptcy more, the market risk or the internal company risk?

To answer this question, the researchers will introduce the beta and the standard deviation of the company's stock. The beta is a measure of the market risk, and the standard deviation shows the overall volatility of the stock. Consequently, *the second objective of this research is identifying which type of risk - systematic or unsystematic – affects the probability of insolvency more.*

This study also examines the behaviour of the Altman Z-score and the Beneish M-score depending on the company's stock performance.

2) The study aims at answering the question whether the low performing companies are more likely to apply manipulations than the big and old multinationals with high returns.

The research sample contains sorting by different types of companies to answer this question. *The objective is to detect that the low-performing companies apply manipulations more often than the well-performers and high-performers.*

2 Literature review

Before the actual literature review is presented, the researchers would like to introduce the inspirational base for this research. The real-life examples are the fundamental basis of the idea of studying bankruptcy. There were huge cases when the company's risk could not be assessed due to the accounting manipulations that were used to cover frauds.

When there is a stock that can provide an enormous return, investors sometimes forget to assess risk (Bratton 2002, 2). The most famous case was probably Enron's bankruptcy in 2001.

Enron was providing energy and gas supplies in California. It seemed a profitable business from the beginning. At its peak, the stock price has reached $90; it was the seventh biggest American company by capitalisation. People who were working for Enron were considered the smartest in the world. Within one year the stock price has fallen to zero, and on 2nd of December 2001, Enron became the most prominent bankruptcy in the history. (Guriev 2013)

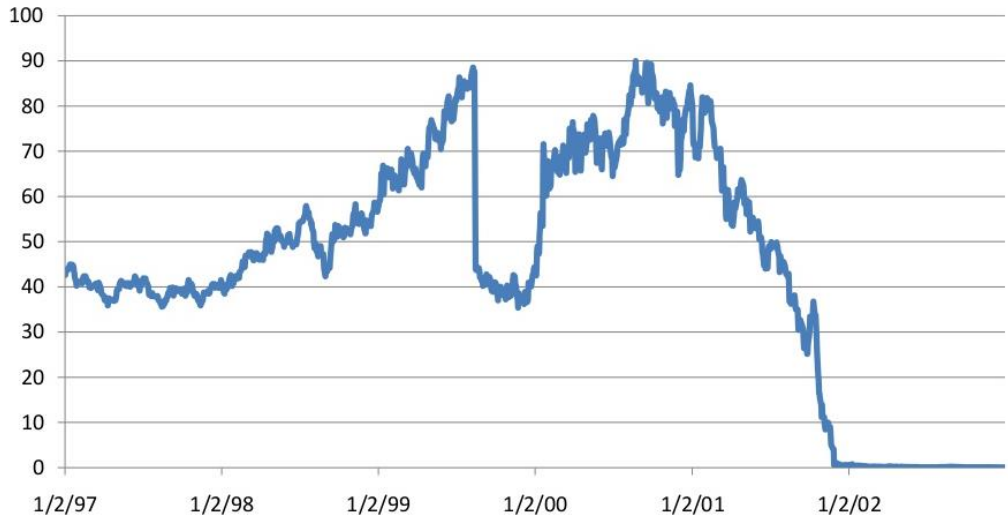

Figure 2.1 Enron's Stock Performance Fluctuation (Guriev 2013)

The first thing that Enron was doing is putting on the balance sheet the profit from deals that were supposed to happen in 20 years. Those deals were only forecasted to bring a certain amount of profit, but, anyway, Enron was putting them in. Such an action is called market-to market manipulation. The second type of fraud was the structured finance. Enron has more than 800 offshore companies that were carrying the financial debt of Enron because they did not want to show their bank liabilities to shareholders. When the fraud was, the world found out, that Enron had not had any profit but survived thanks to the accounting manipulations. (Guriev 2013)

When the research on Enron case was undertaken, there was a typical pattern identified: when the company becomes riskier, it loses links with objective controls. (Bratton 2002, 77)

In the end, people, who suffered the most from Enron's collapse, were employees, who were not able to find a job anymore, and shareholders.

The case about Enron took place 16 years ago. After that, the laws to prevent similar frauds accounting principles has become more strict. Nowadays, this name is associated with corruption and fraud (Sims, Birkmann 2003, 244). This case became the generalised example of big free-market companies whose central principle is making a profit, even though it requires "cooking" the books and lying to shareholders (Tracinski 2002).

However, the ethical question towards the Enron phenomenon still exists. Public companies in their annual reports claim to have sustainable strategies and deliver value to the shareholders, but is it so in reality? What if the reports are faked, and the companies are overvalued? What if the risk associated with them is more than financial analytics can calculate based on the public information?

There was a study when a researcher tried to prove that the bankruptcy of Enron has been predictable. Beneish', Altman' and some more theories have been used to investigate bankruptcy predictability. The study showed that it was possible to predict Enron's failure using this technique, but financial analytics assumed the phenomenon as impossible to be eroded (Tebogo 2011, 14).

Similar research with Altman Z and Beneish M has been undertaken when studying suspicions company's annual reports. The research aims to find the correlation between Altman Z-score and Beneish-M score. Both indicators show that the financial health of the corporation is not profound and the earning management is occasionally (Bal, Rao, Raja 2013, 16).

In this chapter, the literature review on the components of the studied issue will be presented. At the end of this chapter, the reader can find the detailed theoretical framework which is going to be the core of this research.

2.1 Accounting manipulation: definition

Financial statement of a company is a document that provides information on company's financial position (balance sheet), its financial performance and capabilities of the firm, which is crucial for decision making of various stakeholders. According to International Accounting Standards Committee (IASC), financial documentation in the annual report should consist of the balance sheet, income statement, cash flow statement, statement of changes in equity and relative notes to the statements. Except for its evident purpose for the decision-making process, financial statements reflect the effectiveness of an enterprise's management. (Elliot and Elliot 2008, 22-23)

Financial statement of each public listed company is available online for everyone nowadays. Nevertheless, it can be different from the natural earnings of the firm. The reason is that at some point in time managers can record additional current income by adding some value that is expected to come in the next reporting period (Stein 1989, 567). It has been found, that the earning announcement directly affects the share price of company's stock (O'Brien 1988, 56).

This issue is generally known as accounting manipulations.

The early definition of accounting manipulations says that it is a phenomenon when the financial data can be increased or decreased depending on individual's will (Copeland 1968). Beneish himself defines accounting manipulations as an example of managerial actions do beyond the Generally Accepted Accounting Principles (GAAP) with an intention to present firm's financial indicators in a good light (1999). In order to understand the purpose of accounting manipulations, there are some examples of them provided below.

2.1.1 Manipulation classification

Stolowy and Breton have introduced the framework for classification of manipulations. Their findings describe not only types of accounting manipulations, but also various reasons for such actions. The researchers would like to introduce some of the examples of "accounting cooking". (1999)

Earning management is one of the types of manipulations, where managers want to boost earnings in the future. The goal of these measures is to impress the investor. (Degeorge, Patel, Zeckhauser 1999)

However, there is one more side of motivation for earnings management: Scott has stated that managers take benefits from the asymmetry of knowledge with shareholders. (1997)

Managers, whose incentives depends on the equity, can manipulate accruals and accounts to represent lower or higher earnings of the company to benefit from stock selling or purchase. It was also found, that there is a clear relationship between the readability of the Annual report and earning management extent. (Cheng, Warfield 2005)

Another empirical source claims that firms that have a complex structure of their reports are likely to be manipulators. This effect arises from the fact that any efforts to distort the information for the shareholder must have some solid explanation. Such actions often create a cognitive dissonance between the actual performance of the company and the reported results. (Lo, Ramos, Rogo 2017 24)

Fudenberg and Tirole identify *income smoothing* as a way to manipulate with earning timings or reports of revenue with an intention to make the profit growth less variable (1995). In other words, income smoothing is a type of manipulation, where managers tend to create a sense of steadily increasing income.

The purpose of such an action is to ensure the market participants in a healthy growth when the actual profit of the company is growing significantly. It also perceived as a low-risk indicator (Stolowy, Breton 1999).

Another type of accounting manipulations is the “big bath accounting”. The name of it speaks for itself. When a new CEO is coming to the company, some previous savings from accounting manipulations and earnings are set to be “cleaned” to be used for smoothing in the future. Moore suggests that there could be following reasons for it: firstly, representing the low revenue leave a place for historical growth for future comparison. Secondly, improved earnings may be reported in next year. (Beneish 1973)

Sometimes, in the annual reports, one can find *restated earnings*. It is also called earning recast or earning restatement. It is the act of disclosing changed financial information (Investing Answers., 2017). It is a revision of one or more financial statements for a previous fiscal year or several periods. This method is applied when there has been an inaccuracy in calculations found, correct accounting errors, frauds, non-compliance with GAAP (Investopedia., 2017).

Such disclosure of financial inaccuracy summons suspiciousness in shareholders' minds. Mainly it is crucial for financial and managerial activities of an enterprise. It has been calculated, that financial restatements between 1997 and 2002 have resulted in $200 billion in a market loss.

After 60 days since restatement, stock prices of restated companies have fallen by 18 percent. It is proved, that when the company is coming up with its restatements voluntary, it has a positive effect on company's financial position. (Pfaffer, Bartol, Khanin, Zhang 2008, 388)

Thus, one should keep in mind that earning restatement and earning manipulation are different terms. Even though, manipulations are one of the reasons for earning restatements.

2.1.2 Empirical studies on accounting manipulations

Undoubtedly, company's governance is acting in the best interests of the company, but one should consider the fact that such actions may cause severe consequences for the company and stockholders' wealth.

There is some empirical evidence on the correlation between company's financial health and earning management. There have been several studies (Rosner 2003, Charitou 2007) undertaken to investigate the behaviour of low-performing corporations and the way they are applying earning management. It proves that struggling companies surprisingly tend to show the downstream of their earnings.

The other existing suggestion is that managers want to emphasise a particular event, for example, the stock performance. Berstresser and Philippon carried

out a substantial research in 2005 regarding the behaviour of CEOs and earning management.

If the CEO holds companies' stocks, he is more likely to apply manipulations. It was proven by the fact that the accruals of the companies studied were always high when CEOs were exercising options, selling and buying shares. (Berstresser, Philippon 2005)

Nowadays, after the Enron's scandal and economic collapse in the 1980s, more attention than ever has been drawn on the corporate governance. The first corporate governance code, UK's Cadbury Report has emphasised the function of independent board directors, audit committees, and others (Tricker 2012).

In 2002, it was suggested, that the lack of independence in company's Board of Directors may influence the management monitoring in a harmful way. (Klein 2002)

The study undertaken after that in 2003 based on the financial statements analysis and corporate governance statements have found no relationship between the likelihood of manipulations and independence of Board of Directors and audit committee. Instead, the presence of an independent member with a financial background on the board affects the quality of reports (Agrawal, Chadha 2003).

Nevertheless, in 2010, the majority of European investors have marked board independence as the most crucial factor for corporate governance (Bloxham 2010). It has been under justified criticism, that independent directors do not have such an in-depth knowledge of the nature of the company and may not act in the best interest of the enterprise (Tricker, Mallin 2010).

However, one must also take into account the fact, that there are companies that were claiming to have an independent Board of Directors but still were judged for "aggressive" tax avoidance by channelling their profit through offshore tax havens. (Tricker 2012)

In fact, there has been not too much of the research carried out in the field of the dependence of bankruptcy on accounting manipulations. There has been

a study on the impact of earning management before the company is filing for bankruptcy.

This research has confirmed that in case if the business is trying to emerge from the Chapter 11 of the Bankruptcy code of United States (the company that has fallen into Chapter 11 must prepare a reorganisation plan to keep their business alive and pay all the debts. Companies usually seek relief in Chapter 11. (United States Courts 2017)

Therefore, later on, the earning management comes into power, and it usually represents decreased earnings. (Fisher, Gavious, Martel 2016)

2.1.3 Beneish model

The other concept which is going to be the core of the regression in this research is the Beneish model. This model is a framework developed in 1999 with the primary purpose to identify the relationship between the probability of financial manipulations and financial statement variables. Beneish has stated that the most ”unreliable data”, those indicators that companies may facilitate untypical increases in receivables, gross profit, asset quality, sales and increasing accruals.

Further, based on the other models proposed earlier, Beneish has identified eight variables that show the extent of financial manipulations. These are Gross Margin Index, Days Sales in receivables Index, Sales General and Administrative Expenses Index, Asset Quality Index. Also, Sales Growth Index, Depreciation Index, Leverage Index and Total Accruals to Total Assets Index are essential. (Beneish 1999)

The variables represent the extent of firms’ perspectives (the more impoverished the future for the company, the more the probability of manipulation), cash flow and accruals and management incentives. (Beneish 1999)

The interpretation of Beneish Model is rather simple: when eight variables are calculated, those are combined altogether. If the M-score is higher than 2.22, it means that company’s government is using accounting manipulations; if the score is below -2.22, the likelihood of the fraud is less (Beneish 1999).

The limitation of Beneish' theory is that there can be highly cautious manipulators. Taking their data into account may jeopardise the whole framework too.

2.2 Bankruptcy

Definition

The classic definition of bankruptcy is the inability to pay one's debt (Merriam-Webster.com 2017). In the United Kingdom, this term concerns only individuals.

According to the Insolvency Act 1986, which is the same as United States' chapters 7, 11 and 13, the company which cannot cover its debts before the expiry date or whose assets are smaller than liabilities on the balance sheet is called "insolvent". (1986)

The primary goal of filing for insolvency is to maximise return to company's creditors (R3.org.uk., 2008) by the liquidation of company's assets or by comprising court actions against debtor's assets (pwc.co.uk., 2009).

It is possible for the company to overcome insolvency. However, there is a risk that the reputation among creditors will be damaged. Therefore that is why declaring insolvency is the last available option for directors.

After the company had met the requirements to be called insolvent, the court may impose obligations on the company's directors to contribute creditors' losses on the trading that took place after the insolvency. In this case, it will be called "wrongful trading". (Konstantinov 2015).

On the other hand, if directors of the company knew about the insolvency and continued trading it will be considered as an intention to create a loss for the creditors. In this case, it will be called "fraudulent trading", and this is a criminal offence.

Altman Z-Score

Bankruptcy prediction was always perceived as one of the most critical problems for business decision-making (Kirkos 2012, 120). The pioneer in the

solution to this problem is Edward Altman, who has published his multivariate approach in 1968 (Altman, Iwanicz-Drosdowska, Laitinen, Suvas 2014, 2).

He was analysing 53 bankrupt firms and 58 non-bankrupt. The calculations done by Altman are based on the following input data: Working capital, Total Assets, retained earnings (percentage of net income not paid as a dividend), EBIT, the market value of equity, total liabilities and net sales. (Altman 1977).

All the components of the equation describe various creditability dimensions of the company respectively: Liquidity, profitability, the productivity of assets, market-based financial leverage and capital turnover. (Miller 2009)

In his study in 1968, Altman argues previous ways to assess the probability of bankruptcy, because they were all based on some individual signals, like specific financial ratios, for instance. His innovation was about introducing a complex discriminant model that combines five financial ratios derived by Altman and counting their comprehensive impact on the final indicator, the Z-Score. (Altman 1968)

Altman's model has inspired many other researchers to study the question of bankruptcy prediction through some new and developed frameworks. First and foremost, there were some limitations of the first Altman's model (1968).

Initially, Altman-Z theory is not applicable to non-manufacturing companies (Altman 2002). However, there has been a research undertaken by Miller that has used Z-Score for all types of industries, excluding financial and companies – insurance and banking and has come up with results that represent the standard behaviour of Z-Score (2009).

Even though there were so many other studies arguing the efficiency of Altman-Z or proving it less accurate, nowadays it is still one of the most common tools for financial analysis (Misankova, Zvarikova, Kliestikova 2017, 109). Thus, authors of the research have chosen the Altman-Z Model as a bankruptcy probability measure. First of all due to its pioneering nature and secondly because Altman is still continually making researches based on this model and this researches seem to prove model's efficiency.

Empirical studies on bankruptcy prediction

Many theories describe the probability of bankruptcy. There is a controversy in academic world on bankruptcy predictions – many of them evaluate different models for bankruptcy predictions and share different results and opinions.

As it was already stated before, the Altman's model belongs to the type of the Multiple Discriminant Analysis (DMA) models, that was developed in response to the traditional univariate models proposed between 1932-1966. (Siddiqui 2012, 2013)

Consequently, may researchers after Altman have been trying to assess the accuracy, come up with their own models and compare them to Altman's.

In 1999, Shumway was arguing against existing theories of bankruptcy predictions. One of his arguments was that the variables most of them use are unreliable, as researchers look at the data only one year before bankruptcy has happened. Shumway has been comparing different models similar to Altman-Z, and the results gathered with them. (Shumway 2001)

Using the Altman-Z model, he has found that firms that have higher earnings relative to assets are unlikely to fail, companies with a small proportion of liabilities but with a higher working capital are safe, but belong to the so-called "grey area". However, during his research, he has also developed his framework for bankruptcy prediction by enabling some new variables. Those are the firm's size comparing to the market, the standard deviation of firm's stock return and the time dimension. (Shumway 2001)

Shumway's suggestion that Altman-Z had been imperfect and could have presented biased results was supported later.

Based on the Shumway comparison of Altman and Zmijewski model in 2002, another study has proved that Altman-Z score is less efficient compared to the Shumway's model. (Chava, Jarrow 2004)

The research is focused on the suggestion that in various economic sectors there are different levels of competition; the second reason is that the nature of the business affects the way the balance sheet is maintained and

accounting principles implied. The research results have proved the effect of industry influence so that the grouping is crucial when applying any forecasting model (Chava, Jarrow 2004).

In 2009, Miller was comparing different models for bankruptcy prediction. According to his research, stable companies have very close figures generated through those models. However, in severe times for the enterprise Altman-Z shows an increased probability of bankruptcy. (Miller 2009)

In fact, it shows the more dangerous position for insolvent companies then it is in the real world. This ”misbehaving” of Altman-z concerns mainly the ”ordinal insolvency predictions”, which means the competitive rate of probability when comparing to the other company (Bemman 2005).

However, this might be explained by the fact, that the enterprises in this analysis were public, and the variables in the Altman’s equation are both related to market and accounting. If there are problems with company’s financial statements, the market will react negatively to them which will cause the decrease in its market variables.

Some recent studies also prove the imperfection of Altman’s method. For example, the Zmijewski’s probit model (1984) and Ohlson’s model (1980) has been compared by the accuracy with Altman Z. Surprisingly, the Altman-Z has shown the lowest accuracy among them with only 80 percent, and the most accurate model was the Ohlson’s one. (Avenhuis 2013, 38)

However, both Z-Score and O-Score perform similarly poor if compared with Campbell, Hilschare and Szilagyi model. (Mansi, Maxwell, Zhang 2010, 21)

On the other hand, Altman’s model has gone through numerous researches and changes that have increased its predictability nowadays. (Siddiqui 2013, 218)

2.3 Risk and Risk Measurement Tools

As a matter of fact, every business is opened to several risk categories. When doing business entrepreneurs and enterprises face a combination of different types of risk. Those differ in place and time of occurrence, external and

internal factors that create them, level of importance. In general, risk means the chance of things not turning out as expected (Bishop 2009).

Risk can and should be measured. It is crucial to outline that one of the ways to do that is to use objective probabilities. The reason for that is the fact that frequently “a risk describes a situation of an array of different outcomes”, subjective probabilities based on personal judgement of potential outcomes when there is not enough data or even a combination of two (Arnold 2013).

More precisely, the risk is a probability or threat of damage, injury, liability, loss, or any other harmful occurrence that is caused by external or internal vulnerabilities, and that may be avoided through pre-emptive action (Business Dictionary 2017).

A financial risk type exposes a stakeholder to potential losses through changes in the financial markets when speaking of finance-related risk issues. It might also occur when some specific debtors default. (Wissem 2013).

Business is inherently risky, and decision-makers have to be able to identify the risks and make sure they are appropriately managed since some risks can be insured and some cannot be. (Brealey, Myers, & Allen 2011).

Return is another variable for financial managers to consider. It is a total gain or loss experienced in a financial operation (for example, investment) over a set period (Ortobelli Lozza, Petronio and Lando 2015).

Risk and return trade-off is a highly important factor to keep in mind for financial managers too - the returns to investors vary according to the risks they take. Basically, at one extreme, very safe securities can provide a little average return, and the riskiest investments can bring a higher return. (Brealey, Myers, Allen 2011).

Proper classification of risks is a key to the more efficient modern risk management. The following Figure 2.2 designed by Akrani (2012) provides a better-detailed classification of the risk types.

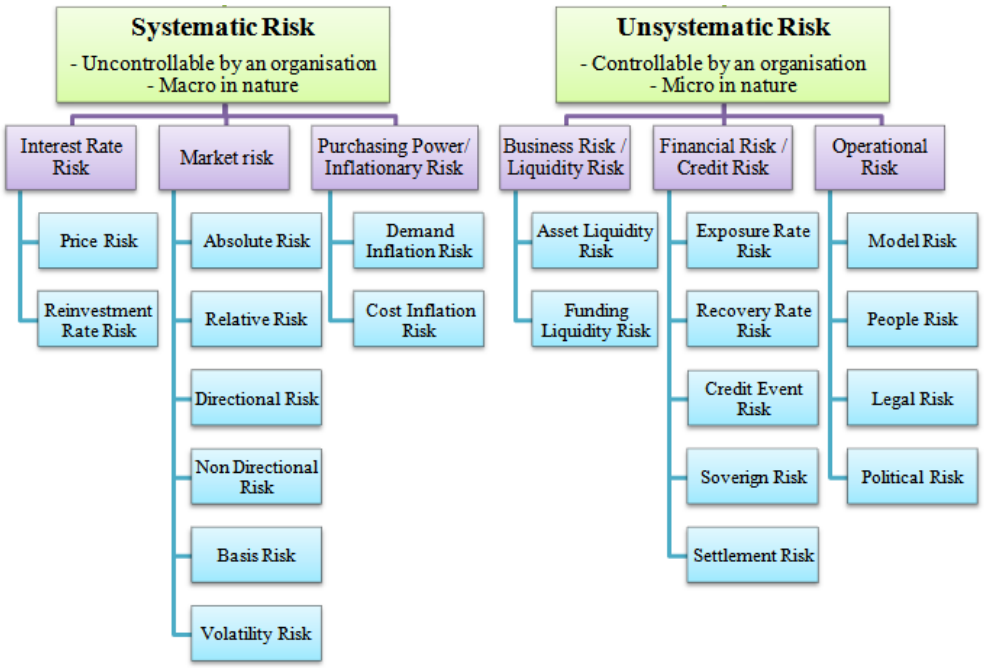

Figure 2.2 Types of Risk in Finance (Akrani 2012)

It has been found out that there are two significant groups of risk: systematic and unsystematic risks. The unsystematic risks are in fact genuinely diversifiable. These risks depend on actions carried out by a company's executives and employees. For example, R&D failure, wrong implementation of a marketing strategy, failed corporate strategy, poor HR policies are unsystematic risks indeed. (Brealey, Myers, Allen 2011).

In the case of the Enron company, the accounting manipulations were one of the internal factors that had affected the company's stability. Consequently, it allows assuming that the quality of annual reports is a part of the unsystematic risk.

On the other hand, the systematic risks are aggregate (macroeconomic) risks that cannot be reduced by hedging and diversification. (Zopounidis & Galariotis 2015). The examples of the systematic risk could be the technology development that leads to the drop in the oil price. Another example is the climate change that affects agriculture – for the food production companies it can turn out into decrease or increase in expenditure on operations.

Therefore, it is time to introduce the Beta Coefficient as a tool for measuring the systematic risk (market risk) and the Standard Deviation concept as a metrics used to evaluate the unsystematic risk of the stock.

Beta as a market risk measurement

Beta Coefficient is the volatility measurement instrument for stock in comparison to a market as a whole. The formula to calculate the beta coefficient is the covariance of the return of stock with the return of the benchmark (in this case the market) divided by the variance of the return of the benchmark (market) over a specified period. (Nickolas 2017)

A stock that is profoundly affected by market fluctuations would have a high beta ratio and have more return if the market grows and have more prominent losses when the market goes down.

Vice versa, if a stock is more stable towards market changes, it would have a relatively lower beta coefficient. If the market decreases the stock losses would be lower than of the market as a whole and if the market grows the return for the stock would be relatively lower than the growth pace of the market (McClure 2017).

To sum up, it is safe to assume that the higher the beta ratio is, the more sensitive is the stock to the systematic (market) risk and vice versa. Thus, the beta concept represents a “market” point of view on the company’s position.

Empirical studies of Beta

The first empirical study on the reliability of the beta coefficient was examining not the particular stocks, but the combinations of them – the so-called investment portfolios. It proved the linear dependence of beta and the stock volatility. (Black, Jensen, Scholes 1972)

In other words, the finding proves that the beta reflects the potential return and loss of the investment. Nowadays researchers test the reliability of the beta coefficient as a systematic risk measure.

Perkovic has found that the beta cannot be trusted entirely, as it is the main component of the Capital Pricing Asset Model (Sharpe 1964), and that model has not proved its reliability. (2011, 102)

During the studies of the beta, the size effect phenomenon has been discovered. The idea is that the bigger the size of an enterprise, the less return it generates, thus, the less likely is the risk and vice vera. (Banz 1981)

Standard Deviation as an unsystematic risk metrics

Risk management concepts suggest wise evaluation of all types of risk. Since unsystematic risk is a vital part of the risk overall, it is essential to pay a great piece of attention to its' scaling. The unsystematic risk is usually associated with each individual stock because of enterprise-specific events and risks. Therefore, it is crucial to find and use a proper metric to measure it. (Douglas 2015).

The standard deviation is frequently used and calculated by investors to make proper evaluations for the unsystematic risk rates of a stock or a stock portfolio. The basic idea is that the standard deviation is a tool to measure volatility: the more a stock's returns differ from the stock's average return, the more volatile the stock is in fact (Mlane 1999).

Originally the term standard deviation is used in statistical analysis to measure the level of dispersion of variables from its average. (Investopedia 2017) In other words, standard deviation shows how the variable might differ depending on the case. A firm's unsystematic risk is usually assessed by the unexplained returns on investment. (Bansal, Clelland 2004, 94)

For the first time, the concept has been introduced by Karl Pearson in 1983 and has been considered the most precise tool to measure the dispersion. (The Economic Times 2017)

In finance, the standard deviation is used to understand the riskiness of the asset. It takes the return of a security within a specified period and compares how it is different from the average share price in this studied period. This type of measure s liked by investors because it shows how different their returns can be. (Morningstar 2015)

Usually, the total portfolio risks are measured by the standard deviation of the prices. (IBF, Institute of Business and Finance 2016) Consequently, the higher is the standard deviation, the more the asset is risky.

2.4 Theoretical Framework Summary

It is essential to find the connections between the models related to the research. The following Table 2.1 sums up the relevance of the used models to the researched topic.

Altman Z	**Based on** the five financial ratios marked in companies' annual reports
	Shows a likelihood of a public listed enterprise's bankruptcy
Beneish Model	**Based on** financial ratios and eight variables that are based on the company's financial statements
	Shows whether the company manipulates its accounts and earnings
Beta Coefficient	**Based on** stock return rates and market return rates over a set time priod
	Shows company's stock risk in correlation with the market as a whole - market risk
Standard Deviation	**Based on** the share price fluctuations over a set time period
	Shows the historical volatility of a stock and helps to predict performance trends in the future

Table 2.1 Research Related Models. Adapted from the Literature Review

The Altman Z-score is a measure of the probability of the bankruptcy. The higher is the output number, the more unlikely is the bankruptcy. The nature of calculation of Altman Z-score is very similar to the Beneish M-Score principle (Jun 2010). However, the Beneish M-score is designed to detect accounting manipulations. The more is the Beneish M output, the more likely the company to be a manipulator.

Consequently, the proof that manipulation of accounts is dangerous for the company's solvency would be a negative correlation between Altman and Beneish' variables. Both of the indicators are calculated based on the official consolidated income statements from the annual reports.

The beta coefficient and the standard deviation are calculated based on the stock price information from the financial databases Yahoo Finance and the Google Finance.

The beta variable measures how the company is vulnerable to the market changes. Therefore, it represents the systematic risk. Logically, the more the beta coefficient is, the more the riskiness is. The researchers seek to find a

correlation between the beta and the Altman Z-score in order to understand if the probability of bankruptcy is defined by the market.

The standard deviation measures the riskiness of the company regardless of the type of the risk. It represents the total volatility of the stock prices. The variable is included in the research to define the proportion of the market risk in the overall riskiness of the company. If there will be a significant correlation between beta and the Altman Z-score, than the correlation between standard deviation must be less. If there will be no correlation between beta and Altman Z-score but with the standard deviation, then it will be possible to assume that what affects the probability of bankruptcy is the internal risk.

3 Methodology

3.1 Research design

The purpose of disclosing the research design is to show how the research questions are linked to what the researchers did to answer them. (Saunders, Lewis, Thornhill 2009, 136) The scholars have suggested a technique for a description of the research design, called a “research onion”, that opens the approach, the strategy, the method and the time horizon of the study. (Saunders, Lewis, Thornhill 2009, 109)

In the beginning, the research philosophy is going to be discussed. The *constructivism* philosophy is widely applied to the learning process. It suggests that the knowledge should be constructed by the learner in order to make sense of the perceived experience. (Driscoll 2005, 387) The process of learning, according to constructivists, is arising from comparing the existing knowledge with new information and generating new ideas. (Ferguson 2015) In this paper, researchers are trying to build a new connection between two very well studied topics – accounting manipulations and the probability of bankruptcy.

The main condition for the constructive knowledge is the multiple perspectives and models of learning. (Driscoll 2005), this is why the materials will be carefully analyzed as each case in particular and as an overall statistical evidence.

The research approach defines how sure the researcher about the theory that he or she is testing. (Saunders, Lewis, Thornhill 2009, 124) This research idea has been generated by the real-life examples of Enron, Lehmann brothers and Northen Rock when companies had failed because they have applied accounting manipulations in one case, and also when they tried to play fair in another one. Thus, there is an explicit theory that researchers are testing, which means that the research approach is *deductive*. The data for testing the theory is going to be collected from the annual reports of 18 companies and also share price data for the period from 2010 to 2015. Thus, the research can be called *archival*.

For the data analysis, only the numerical data will be collected and analysed through the SPSS quantitative analysis platform and excel, for presenting the visualisation of the data. It is called a mono-method quantitative research.

The primary data sources are the annual financial statements of the sample companies and the historical share prices taken from the online financial databases Yahoo Finance and Google Finance. The secondary data are the Beneish M-score and the Altman Z-score, calculated based on the information from the annual reports, and the beta and standard deviation that are derived from the share price history.

3.2 Data collection

In this chapter, the principle of choosing and analysing sample companies is going to be presented. As long as there are 18 companies presented, the researchers suggest that it would be more reader-friendly to introduce a coding framework for more efficient communication. (Table 3.1) Also, the following table helps to understand the overall approach to the sample of companies.

	Retail (A)	Food production (B)	Technologies (C)
High-performing (1)	2x**A1**x5 years	2x**B1**x5 years	2x**C1**x5 years
Well-performing (2)	2x**A2**x5 years	2x**B2**x5 years	2x**C2**x5 years
Low performing(3)	*2x**A3**x5 years*	*2x**B3**x5 years*	*2x**C3**x5 years*

Table 3.1 Types of sample companies

Numbers from one to three represent the level of performance of chosen companies. 1 – the high-performing companies, 3 – low-performing. There are six companies of each level, two for every industry. This classification has been introduced for assessing companies with different stock performance images and also with the different level of profitability, as the reader will see from the analysis below.

The letters A, B and C are representing the three different industries where chosen companies operate. Retail, Food production and Technologies respectively. There are six companies in every type of industry. This division by economy sectors has been introduced to remove the research bias coming from the market affection – some industries, technological, for example, are riskier and less liquid than retail, for example.

For example, if the reader sees the B2 code, it states for the well-performing food production company. In total there are 18 companies, nine types of them and two companies of each type. That is why two companies in the research will be marked with the same code.

As long as the study period for this research is five years, for each company, the information will be taken from 5 annual reports. (In the references the reader can find the links to each company's investor's page where all the reports can be found and accessed.) In total, the data for the Altman-Z score and Beneish-M has been gathered from 90 annual reports.

The data for calculation of market-driven variables have been taken from the financial databases of Yahoo.com, Inveting.com and Google Finance.

Below, the reader can find detailed information on the critic factors for choosing companies and data calculations. Those are the location, market performance, market index, reliability of the historical financial information, and presence of financial restatements.

Location: United Kingdom

For the sake of the validity of results, all the company have been taken from the same country, United Kingdom. It is worth to be mentioned, that studied period is marked as an extremely efficient for British economy after the 2007-2008 crisis. The national statistics office has published figures that show that British GDP is increasing each year since the beginning of 2010. (Office of National Statistics, 2017) This period is beneficial for the research as results will not be biased with the effect of the economic crisis.

As long as this research studies the dependence of bankruptcy on the quality of the accounts reported, global unstable economic conditions may bias the results. Therefore, studying peaceful British companies might provide more reliable empirical evidence on the issue.

Market performance: high-performing, well-performing and low-performing.

There are three kinds of companies (1-3) that are different regarding their market performance. According to Horne J.C.V and Wachowic J.M., the stock price indicates precisely the level of firm's financial capabilities, asset management and investment. The scholars also mention that maximising the wealth of shareholder is a final goal of a public corporation (2008). Therefore, the indicator for assessing the market performance of the enterprise is their share price development within a period of 5 years, starting from the 1st of January 2010 and ending 31st of December 2015.

Market Index: FTSE100

Critical dimension for the Beta data collection is the belongings to the same stock index. Companies studied in this research are all listed at London Stock of Exchange and naturally UK companies. However, London stock exchange

work with several indexes, which have different prices. Some of the analysed companies are listed on FTSE100; others are on FTSE250.

The main difference between this two is that FTSE100 represent a hundred largest UK corporations, whereas FTSE250 correspond to the next 250 largest companies. Secondly, FTSE100 better show the global position of UK on the market, as the largest companies are multinationals. (Standard Life Self Investor 2017).

As long as the majority of the companies in this research also operates outside of the UK, the researchers consider acceptable to calculate beta only based on the FTSE100 data.

Financial results up to date

Under perfect conditions when all the firms are publishing their financial statements on December 31 all of them would be taken from the period of 2010 and 2015. This setting has been implemented to have a more relevant data, not biased with political priorities in the world and global crisis affection. However, in reality, the due for publishing annual reports vary for every company depending on the financial year beginning.

For example, some reports that are officially dated 2010 may contain statements prepare for the financial year end on the March 31 of 2010. In practice, these figures reflect more the financial position of 2009. If such cases appear, the financial information for 2010 will be taken from the report official published in 2011.

Financial restatements

Earning restatements is a revision of one or more financial statements for a previous fiscal year or several periods. This method is applied when there has been an inaccuracy in calculations found, correct accounting errors, frauds, non-compliance with GAAP (Investopedia 2017).

Some of the sample companies have been publishing the reports with a restated earnings for the previous year. For the data analysis, the restated figures had been selected. This decision has been taken because of all the

companies restatement can be explained by the modification of the same amendment in the accounting policies demanded by GAAP. Therefore, the restated data is valid according to the law.

Further in this chapter, the information on the sample companies will be presented. It is supposed to contain only necessary information for the justification of choice based on the dimensions described in above.

Justification of choice for the sample analysis

In this chapter, the researchers intend to present all the sample companies detailed description. This description will include the overview of the nature of the business, the assessment of the operational performance of the company and how it is reflected on the market, the publishing policy and the reasons for earning restatements if those happened.

Dunelm Group Plc (A1)

Dunelm Group is a leader in homewares retail in the United Kingdom. In 2015, there were 149 Dunelm superstores in suburban areas and six high streets among the country overall, as well as an online store with a possibility of home delivery or reservation in stores. This information is relatively repeated by the share price indicators.

Figure 3.1 Dunelm Group Plc market performance and FTSE100 fluctuation (Google Finance 2017)

Figure 3.1 represents the fluctuations of the share price of Dunelm Group. The evident and straightforward growth fully justifies the reason for considering Dunelm as a well performing retail company.

Dunelm group annual reports are published at the end of June, beginning of July. Therefore the figures in account reflect half of the current year and half of the other. The researches consider this shift not significant for the study and the 2010 publications are recorded as the data for an entire 2010 year. The share prices data for calculation is going to be taken from the 1st of July.

The company did not restate it' earning during the studied period.

WH Smith Plc (A1)

WH Smith is a British retailer of books and newsagent. By 2015, the company is running two businesses - Travel (selling of newspapers, magazines, books, and supporting products in airports, train stations, and others) and High Street (selling books, stationery, newspapers and entertainment products in convenient places).

The growth of WH Smith Plc within five years is reflected in its net profit that has increased by 30 percent. Also in 2010 it had 1,089 shops total, but by 2015 there were already 1,315. (WH Smith Annual reports 2010 2015)

This real growth is represented by the stock performance.

Figure 3.2 WH Smith market performance and FTSE100 fluctuation (Google Finance 2017)

Figure 3.2 represents the straightforward growth of WH Smith's stock. As well as in the previous case with Dunelm Group, WH Smith has been showing an increase in its net and operating profit during the studied period. Moreover, it is reflected in the healthy market growth of the company.

WH Smith publishes its reports on 31st of August. Therefore the figures in account reflect more the current year than the previous. The researches consider this shift not significant for the study and the 2010 publications are recorded as the data for an entire 2010 year. Thus, the information on the stock price for calculations will be taken from the 1st of September.

The Group has made earnings restatement for the years 2012 and 2013. The reason for restatement is an adaptation of new mandatory standard IAS 19.

Associated British Foods (B1)

Associated British Foods is a multinational diversified food, ingredients and retail group, which operates internationally in Europe, Asia, Australia and Oceania, Southern Africa, North America, and South America.

There are five strategic business segments of British Foods under different brands: Grocery (Twinings, Ovaltine), Sugar, Agriculture (AB Agri), Ingredients for a bakery (AB Mauri) and Retail (Primark). The last segment is the most profitable. (Associated British Foods Annual Report 2015)

During the 2010-15 the profit of the company has remained relatively at the same level, £569,000 in 2010 and still £524 in 2015. However, the corporation has expanded its market to 4 more countries, starting from 44 and ending with 48 at the end of the period. (Associated British Food Annual reports 2010, 2015)

Figure 3.3. Associated British Foods market performance and FTSE100 fluctuation (Google Finance 2017)

In Figure 3.3, one can find the evidence of constant share prices growth of Associated British Foods. The growth of the share price remains sustainable even though there has been no significant increase in profitability. This curve justifies assuming that the observed company can be called high-performing.

The end date of the financial year for Associated British Foods is the middle (12-19) of September. Therefore the figures in account reflect more the current year than the previous. The researches consider this shift not significant for the study and the 2010 publications are recorded as the data for an entire 2010 year. Thus, the share price figures are dated the 1st of October. It is assumed, that 15 days will not create a significant impact if the studied period is five years.

The company has been applying restatement of earnings for the year 2012 and 2013. In 2014 company adopted new accounting policy (IAS 19) for employee benefits, which affected 2013 and 2012 retained earnings and shareholder's equity. (Associated British Foods annual report 2014)

Cranswick Plc (B1)

Cranswick Plc is an innovative British supplier of food. The core market of Cranswick is the UK, and they mainly provide different meat products and sandwiches through retail, food services and manufacturing. Nowadays 95 percent of revenue comes from the UK, and five from Europe, Australasia, West Africa and the US. Retail customers generate 75 percent of revenue. Cranswick operates through brands – Bodega, Simply Sausages, Yorkshire Baker, Woodall's and Jack Scaife. (Cranswick Plc Annual report 2015)

Figure 3.4. Cranswick Plc market performance and FTSE100 fluctuation (Google Finance 2017)

From the curve, in above one can see a slight but continuous growth of company's stock price. Considering the fact, that operating profit of Cranswick has always been growing (except slight fall in 2013). Also, the Earnings per share indicate continuous growth from 1990. (Cranswick Annual report 2015) Thus, this company is assumed as high-performing in this research.

Cranswick's annual reports are usually published on the 31st of March, which covers only a third of a studied year. Consequently, the data for 2010 will be taken from the 2011's annual report. Thus, the share price for calculations will be taken from the 1st of April.

Company's government has applied new accounting policies (IAS 19, IAS 27, IAS 28) concerning employee benefits and investment policies. Those changes affected financial statements for 2013 (actual 2012) only.

E2V Technologies (C1)

E2V company is a world-leading technology company that design and supply innovative solutions for partner companies in healthcare, science, space and defence industries. (E2V Annual Report 2010, 2) E2V operates through three business segments: Imaging, RF Power and Semiconductors. More concrete, they produce screen sensors, and camera solutions, space imaging sensors, some radio-based system components and also provide human resources for design and engineering. (E2V Annual Report 2016)

According to the development of the employee number, the company did not expand a lot, starting with 1,666 people in 2010 and 1,645 in 2015. However, the operating profit o the company has more than doubled, with a £15 million to £42 million. (E2V Annual Report 2010 2016)

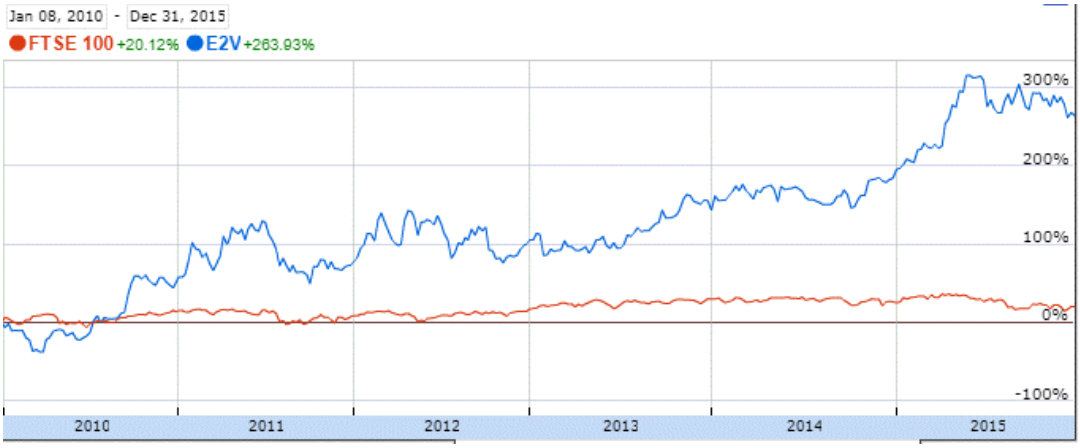

Figure 3.5. E2V Technologies market performance and FTSE100 fluctuation (Google Finance 2017)

The growth of the shareholders' appreciation is evident from the share price fluctuation on Figure 3.5. At the beginning of 2010, E2V had slight problems regarding the falling demand for the products. (E2V Annual Report 2010)

E2V publishes its annual reports on the 31st of March, which covers only a third of a studied year. Consequently, the data for 2010 will be taken from the 2011's annual report. Thus, the share price for calculations will be retrieved from the 1st of April.

The company has introduced earning restatements for the financial year ended 31st f March 2013. The reason was the adoption IAS 19 amendment, that affected company's benefit schemes and, in turn, company's total assets.

Worth to be noted, that by the current ay the company does not exist anymore. In December 2016 it was taken over by a US "Teledyne". The cost of the deal was £620 million. (Fedor 2016)

Halma Plc (C1)

Halma is a tech British company listed on FTSE250. The enterprise operates in Europe, Asia and the USA through five main business formats. These are

protection life (products that help to protect from dangerous gases, flame detectors and corrosion monitors, sensors and audio warning systems); life quality improvements (products for healthcare, water quality monitoring devices) (Halma Annual report 2015, 5)

In 2010 Halma had entities in 22 countries with the overall amount of employees 403 people. After just five years the number of employees has been increased dramatically to 5,411. By 2015 the company has been operating in 23 countries already. The operational growth can be seen from the difference between PBT (Profit Before Tax) in 2010 and 2015, which corresponds to £86 million and £153 million respectively.

Figure 3.6. Halma Plc market performance and FTSE100 fluctuation (Google Finance 2017)

This growth both in the actual size of the company and its economic capacities is well reflected in the overall growth. All these factors allow the researchers to consider Halma as a high-performing company.

Halma Plc publishes its annual reports on the 31st of March or in the first date of April, which covers only a third of a studied year. Consequently, the data for 2010 will be taken from the 2011's annual report. Thus, the share price for calculations will be taken from the 1st of April.

The company has introduced earning restatements for the financial year ended 31st f March 2013. The reason was the adoption IAS 19 amendment that affected company's benefit schemes and, in turn, has decreased company's taxable profit.

Kingfisher Plc (A2)

Kingfisher is a multinational retailer of home improvement materials, based initially in the United Kingdom. Together with products the company is also offering the home improvement services.

During the studied period, the company has significantly increased its amount of stores, starting with 831 stores in 2010 and 1,156 in 2015. Enterprise has expanded its sales to three more countries (2010: 8, 2015: 11), so as the number of employees (2010: 64,576, 2015: 74,000). However, the size expenditure has not also been supported by the taxable profit's slight growth (2010: £566m., 2015: £686m.) (Kingfisher Annual reports 2010, 2016)

Figure 3.7. Kingfisher Plc market performance and FTSE100 fluctuation (Google Finance 2017)

In Figure 3.7, one can observe the development of the stock performance. The research considers Kingfisher Plc as a well-performing company. This assumption is due to the fact of the relative share price growth, but at the same time, extreme points in 2013 and 2014 do not correspond to the stable market performance.

Kingfisher Plc publishes its annual reports on the 31st of January – 1st of February. Thus, the data presented covers almost the entire previous year. Thus, the data for the 2010 calculations will be taken from annual reports dated 2011. The share price information will be gathered from the 1st of February each year relatively.

The company applied earnings restatements to 2013's data. The reason for the restatement has been the changes in the IAS19 amendment on the employee benefits.

Marks and Spencer Group Plc (A2)

Marks and Spencer Group Plc is a famous British retail company that specialises in clothes, home products and food. The company is multinational. It operates in UK and 59 countries more. (Marks and Spencer Annual Report, 2015)

In 2010 the company was operating in 42 countries only and had 1,010 stores in total. By 2015 the number of stores had grown up to 1,330, together with the international exposure. The taxable profit of M&S had experienced rises and decreases, but by 2015 it had accounted for £600 million, whereas in 2010 it had been £702 million. However, the fact that the company's history is more than 125 years, it can be seen as a healthy stable development. (Marks and Spencer annual reports 2010, 2016)

Figure 3.8. Marks and Spencer Group Plc market performance and FTSE100 fluctuation (Google Finance 2017)

According to the Figure 3.8 in above, one can see a general increase in the share price, but the growth has not been stable and sometimes even underperform in comparison with the market growth. Therefore, in this research, the company is assumed as a well-performing.

Marks and Spencer Group Plc publishes its annual report at the end of March – Beginning of April. Consequently, the data for 2010 will be taken from the 2011's annual report. Thus, the share price for calculations will be taken from the 1st of April.

In 2013 Marks and Spencer has introduced the income restatements due to the IAS 19 amendment change concerning the employee benefits.

Devro Plc (B2)

Devro is a B2B type food production company that supplies collagen gel to the food producers of different kinds of sausages. Devro operates in more than 100 countries and has a range of more than 1,500 customers. (Devro Annual report 2015)

During the studied period, the number of employees of the company increased from 1,484 to 2,258. However, after 2013, the company's revenue had never been showing a positive development. The operating profit of Devro had fallen from £38,000 in 2010 to £19,000 in 2015. (Devro Annual reports 2010, 2013, 2015)

Figure 3.9. Devro Plc market performance and FTSE100 fluctuation (Google Finance 2017)

Regardless of the operating profit fall, one can notice an increase of company's stock in general. However, the profitability gap is seen as a slight drop in 2013 onwards. Because the financial indicators of the company and its

stock fluctuations are unstable, but anyway positive, Devro Plc is considered as a well-performing company.

The company publishes its reports always in 31st of December. Thus, the financial data for 2010 will be taken from the annual report dated 2010. The share price figures will be taken on the 1st of January.

There has been an earning restatement in 2011 for the financial year 2010 concerning the IFRS5 amendment about discounted operations held for share. The 2012 results are affected by the IAS19 amendment about the employee benefits.

Tate & Lyle Plc (B2)

Tate and Lyle Plc produces specific food ingredients for adding taste, structure and nutrition to the actual food produced by their customers. The company is a multinational, operating in Europe, North and South Amerca, Asia and Australia. (Tate&Lyle Annual report 2015)

In 2010, the net profit of Tate&Lyle was accounting for £19 million. The number of employees was 5,616 people. Comparing to the previous and next financial years it seems relatively low. However, this was due to the payment of company's financial debt. In 2014 the profitability of the enterprise increased to £273 million and then dramatically dropped to £30 million. Furthermore, the financial report for 2015 has shown that the net debt of the company has significantly increased. (Tate&Lyle Annual Reports 2010, 2015)

Figure 3.10. Tate & Lyle Plc market performance and FTSE100 fluctuation (Google Finance 2017)

The fluctuations of the Tate & Lyle's share price reflect perfectly the profitability of the company. The stock history saw its' rises and decreases, but in the long run, there is no significant drop. Thus, Tate & Lyle is assumed as a well-performing company in this research.

Tate & Lyle publishes its annual reports always on the 31st of March. Consequently, the data for 2010 will be taken from the 2011's annual report. Thus, the share price for calculations will be taken from the 1st of April.

There has been a restatement of earning for 2013 (actual 2012) financial year. The reason for the restatement has been the changes in the IAS19 amendment on the employee benefits.

Univision Engineering Ltd (C2)

Univision Engineering is a Hong Kong-based producer of equipment for security issues. The primary clientele of the company is the security system service providers and alarm manufacturers. Mainly the company operates in China, with 60 projects undertaken there within past years. (Uvel 2017)

Even though the company is Limited, its stock is traded on the London Stock Exchange, and the annual reports available for public and the primary trading currency is British Pounds.

Since Annual reports of the company are made rigorously and humbly, it is difficult to assess the physical size of the company. However, the Property, Plant and Equipment, marked in the financial statements decreased dramatically from £285,000 in 2010 to £43,000 in 2015. The profit of the company was also fluctuating a lot. In 2010, the company had a loss of £10 million. During 2011 and 2014 there were positive results presented, however, on the 31st of March 2016, the loss was £340,600. (Univision Engineering Annual Reports 2010, 2016)

Figure 3.11. Univision Engineering Ltd market performance and FTSE100 fluctuation (Google Finance 2017)

This stock of the company does not reflect its reported financial statements. The dramatic peaks can be explained by the company having very successful periods reported and as well as losses. In the long run, Univision Engineering is considered a well-performing company because the stock price does not have a significant drop in the studied period.

Univision Engineering publishes its annual reports always on the 31st of March. Consequently, the data for 2010 will be taken from the 2011's annual report. Thus, the share price for calculations will be taken from the 1st of April.

There were no restatements on financial indicators reported during the studied period.

Spectris Plc (C2)

Spectris is a company that produces the instruments for controlling environment, quality and manufacturing processes for R&D and the laboratory purposes as well as for the manufacturers. Spectris is a multinational company that operates in North America, Europe and Asia mainly. (Spectris Annual Report 2015)

The development of Spectris profitability correlates well with its stock correlation (Figure). In 2010 the profit was £96 million. Between 2011 and 2013 there was a noticeable growth of the profitability, and in 2015 the indicator again fell, accounting for £113 million. In 2010 the number of

employees was 5,781 people. By 2015 it had already been 8,053, which tells about the actual size of the company and possible projects.

Figure 3.12. Spectris Plc market performance and FTSE100 fluctuation (Google Finance 2017)

The Spectris Plc is considered as a well-performing company in this research as the stock price has not been fluctuating dramatically and in the end, accounted for more than at the beginning of the studied period. However, the profitability is no stable, so it is not the high-performing.

Spectris Plc publishes its annual reports only on the 31st of December. Thus, the financial year and the actual year are in alignment, the data for 2010 will be taken from the annual report dated 2010. The share price data will be taken from the 1st of January.

In 2013 Spectris announced earning restatements for the financial year 2012 due to the change in IAS 19 amendments concerning employee benefits.

Debenhams Plc (A3)

Debenhams is a British multinational retailer of apparel, accessory and homeware. The history of the company in the British market is more than 200 years. Nowadays the company makes sales through the high street stores and online platform. (Debenhams Annual report 2015)

According to the profitability indicators, Debenhams has reported a slight decrease in profit, with £97 million in 2010 and £93 million in 2015. However, the number of stores has increased from 227 in 2010 to 248 in 2015. Another

point that indicates company's precarious position is the decreased number of employees, which fell from 30,417 in 2010 to 28,127 in 2015. (Debenhams Annual reports 2010, 2015)

Figure 3.13. Debenhams Plc market performance and FTSE100 fluctuation (Google Finance 2017)

First and foremost, Debenhams is a company that operates on the market for more than 200 years, and it is strange to see such a fluctuation of stock price for an old company. Secondly, at the beginning of the studied period, Debenhams Plc's share price was more than at the end of 2015. The significant rise at the end of 2012 was followed by a decrease after. Thus, the Debenhams Plc is assumed as a low-performing company in this research.

Debenhams Plc usually publishes its Annual results on the 31st of August. Since more than a half of the reported calendar year is reported, the data for 2010 will be taken from the annual report dated 2010. The share price data for calculations will be taken from the 1st of September.

Debenhams reported the restatement of earning for 2013. The restatements took place due to the change in IAS 19 amendment on employee benefits. (Debenhams Annual report 2014)

Stanley Gibbons Group Plc (A3)

Stanley Gibbons is a British retailer of post stamps, collection products, autographs and other philatelic accessories and literature. The company also trade coins, jewellery, antique furniture. It publishes catalogues in hard copies,

manufacture albums for the order, set up auctions. Stanley Gibbons is a B2C company. Officially company is not British because it belongs to the Jersey Island. However, this position only affects the rights of shareholders. It operates mainly in the UK. However, it also has subsidiaries in Jersey, the USA, Singapore and Hong Kong. (Stanley Gibbons 2017)

The profitability of the company has been decreasing through the studied period continually. In 2010, the operating profit and the net profit accounted for £4,887 and £3,831 respectively. (Stanley Gibbons Annual report, 2010) By 2015, the profit has fallen more than just significantly. The net loss of Stanley Gibbons was 29,249. The Chairman of Stanley Gibbons has stated the significant fall was due to the wrong merger and accusation policy and overall Internat development. (Stanley Gibbons Annual report 2016)

Figure 3.14. Stanley Gibbons Group Plc market performance and FTSE100 fluctuation (Google Finance 2017)

Despite the constant decrease of company's profitability, one can see on the Figure 3.14 that before 2014, the stock price has been developing straightforward. However, in summer 2015, the significant profitability fall affected the investors' loyalty, and the stock went down dramatically. Thus, Stanley Gibbons is assumed as a low-performing company in this research.

Before 2013, Stanley Gibbons has been publishing its annual results on the 31st of December. However, on the 31st of December 2013, there were only mid-term results. The full report was presented on the March 31st of 2014. Afer this, company's financial year ends on the 31st of March always. The data for

calculations for 2010 – 2012 will be taken from the reports dated the same year, but for the rest, it will be the next year.

Stanley Gibbons has introduced earnings restatements for 2010 and 2011, without a proper explanation. In 2012 the earnings were restated due to the effect of the change in IAS 19 amendment concerning the employee benefits.

R.E.A. Holdings Plc (B3)

REA Holdings is a British manufacturer of palm oil. The main manufacturing centre is located in East Kalimantan, Indonesia. REA Holdings also makes a profit by providing electricity in the neighbouring villages in the are of their plant. (REA Holdings Annual report 2015)

The number of employees working for the company in 2010 was 7,400 people, but at the beginning of 2015, it was 9,800. However, in the end, the amount had been decreased back to 7,400. The profitability of REA Holdings is highly unstable, but the overall trend is downward. In 2010 the profit of the company was £20,000, in 2013 the loss of £9,000, and in 2015 the net income accounted for £2,000.

Figure 3.15. R.E.A. Holdings Plc market performance and FTSE100 fluctuation (Google Finance 2017)

The decrease that can be seen in the Figure 3.15 represents the result of palm oil price in general. Every year the vegetable and animal fat production is increasing so that the palm oil is becoming less convenient. (REA Holdings

Annual report 2015) Also, the company's unstable profitability might affect the curve.

REA Holdings publishes its' reports always on the 31st of December. Thus, the financial year and the actual year are in alignment, and the data for 2010 will be taken from the annual report dated 2010. The share price data will be taken from the 1st of January.

During the studied period, REA Holdings did not report any earnings restatements.

Even though the REA Holdings is initially a British company and it is traded on London Stock Exchange, the currency in which the financial statements are presented is the US Dollar. For calculations, the researchers converted the figures into Great Britain Pounds according to the end date of each financial period. The exchange rate information has been retrieved from Xe.com.

Premier Foods Plc (B3)

Premier food is mainly a domestic producer of food, with 5 percent of sales going international. They produce quick meals, desserts, sweets and sauces.

The profitability of Premier Foods during the studied period had always been somewhat a loss. In 2011, the loss accounted for £339 million. By 2015, it was £123 million. However, the number of company's employees increased from 2,000 people in 2010 to 3,737 in 2015, which is an evidence of business expansion.

Figure 3.16. Premier Foods Plc market performance and FTSE100 fluctuation (Google Finance 2017)

The Figure 3.16 suggests that the shareholder's attitude to British Foods is decreasing every year during the selected period. The chairman claims that the negative profitability trend is due to the change in consumer habits and growing commodity costs. However, as one can already notice from the previous food companies analysis, other food producers do not suffer from these factors in the British market.

Before 2013, Premier Foods has been publishing its annual results on the 31st of December. However, on the 31st of December 2014, there were only mid-term results. The full report has was on the 4th of April of 2015. Afer this, company's financial year ends at the beginning of April. The data for calculations for 2010 – 2013 will be taken from the reports dated the same year, but for the rest, it will be the next year.

For the year 2011 Premier Foods has reported restatements due to the company's reclassification of costs. The same reason for restatements occurs in 2013. In 2012 the reason for the earnings restatement was the change in IAS 19 amendment concerning benefits for employees.

Artilium Plc (C3)

Artilium is a B2B tech company that focuses on the development of software solutions and communication applications. Artilium Plc is listed on London Stock Exchange but with headquarters in Belgium.

Artilium reported positive profit results only in 2014, with £170,000 in plus. All the other years of the studied period company has been facing losses. In 2010 the loss was £3,509 million. By 2015 it had already been £161,000. The number of employees had not changed significantly within five years. The intangible assets indeed increased from £585,000 in 2010 to £1,805 million in 2015. Such a change underlines that the tech company just was not innovative enough with the supported solutions.

Figure 3.17. Artilium Plc market performance and FTSE100 fluctuation (Google Finance 2017)

Shareholders' negative attitude is represented in Figure 3.17. Artilium is assumed in this research as a low-performing company because of the negative profit reported and the following respond of its shareholders.

Artilium publishes its annual reports always on the 30th of June. It means that the annual report usually covers less than half of the studied year. Thus, the results for 2010 will be taken from the annual reports of 2011 and so on.

During the studied period, there was no earnings restatement reported.

Oxford Instruments Plc (C3)

Oxford Instruments is a British tech company with a history of more than 55 years. It produces nano-technology tools for research, industrial products and service solutions. Oxford Instruments is a multinational with offices in 16 countries, including the USA, Europe and Asia.

The number of employees of the company increased from 1,566 people to 2,077 in 2015 worldwide. In 2010, the profit of the company was £32,2 million, and in 2015 it was only £7 million. During the studied period, in 2014 Oxford Instruments announced a loss of £6.3 million.

Figure 3.18. Oxford Instruments Plc market performance and FTSE100 fluctuation (Google Finance 2017)

As one can see from the previous figure, the stock performance of the company was going up until 2013. The followed decrease is suggested to be due to the negative results reported. Even though the company's share price at the end of 2015 is more than at the beginning of 2010, it is assumed as the low-performing company anyway because of the negative profit reported.

Oxford Instruments publishes its annual reports always on the 31st of March. Since more than a half of the reported calendar year is reported, the data for 2010 will be taken from the annual report dated 2010. The share price data for calculations will be taken from the 1st of April.

Oxford Instruments has reported the restatements of earnings for 2010 and 2013. For 2010 there was no explanation found in the report, and for 2013 the reason was the IAS 19 amendment concerning the employee benefits.

3.3 Variables description calculation

In this part of the methodology chapter, the formulas of calculation each variable will be disclosed. At the end of this section, the reader can find the explanation of each financial term used in the calculations.

Beneish M-score

The research by Nesson Beneish suggests that the detection of bankruptcy might be done through a set of financial statement ratios combined in several indexes. (Beneish 1999)

According to Beneish, there are 8 Indexes that must be calculated for the final score calculated. Those variables show the change within years in financial indicators. (Beneish 1999)

Days Sales in Receivables Index = (Receivables$_t$[2]/Sales$_t$[12]/(Receivables$_{t-1}$/Sales$_{t-1}$)

$$\text{Gross Margin Index} = \left(\frac{\text{Sales}_{t-1}[12] - \text{Costs of Goods Sold}_{t-1}[41]}{\text{Sales}_{t-1}[12]}\right) / \left(\frac{\text{Sales}_{t}[12] - \text{Costs of Goods Sold}_{t}[41]}{\text{Sales}_{t}[12]}\right)$$

$$\text{Asset Quality Index} = \left(1 - \frac{\text{Current Assets}_{t}[4] + \text{PPE}_{t}[8]}{\text{Total Assets}_{t}[6]}\right) / \left(1 - \frac{\text{Current Assets}_{t-1} + \text{PPE}_{t-1}}{\text{Total Assets}_{t-1}}\right)$$

$$\text{Sales Growth Index} = \text{Sales}_{t}[12]/\text{Sales}_{t-1}$$

$$\text{Depreciation Index} = \left(\frac{\text{Depreciation}_{t-1}[14 \text{ less } 65]}{\text{Depreciation}_{t-1} + \text{PPE}_{t-1}[8]}\right) / \left(\frac{\text{Depreciation}_{t}}{\text{Depreciation}_{t} + \text{PPE}_{t}}\right)$$

$$\text{SGA Index} = \left(\frac{\text{SGA Expense}_{t}[189]}{\text{Sales}_{t}[12]}\right) / \left(\frac{\text{SGA Expense}_{t-1}}{\text{Sales}_{t-1}}\right)$$

$$\text{Leverage Index} = \left(\frac{\text{LTD}_{t}[9] + \text{Current Liabilities}_{t}[5]}{\text{Total Assets}_{t}[6]}\right) / \left(\frac{\text{LTD}_{t-1} + \text{Current Liabilities}_{t-1}}{\text{Total Assets}_{t-1}}\right)$$

Accruals to Total Assets= [fCurrent Assets$_t$[4]-fCash$_t$[1])-(fCurrent Liabilities$_t$[5] - fCurrent Maturities of LTD$_t$[44]-fIncome Tax Payable$_t$[71])-Depreciation and Amortization$_t$ [14]]/ TA$_t$[6]

Figure 3.19. Beneish M-Score Indexes Formulas (Beneish 1999, 23)

Days Sales in Receivables index (DSRI) measures whether the balance between revenue and receivables is kept within two years.

Gross Margin Index (GMI) compares the gross profit of the previous year to the current. It has been studied, that a dramatic change in gross margin positively correlates with the earning management.

Asset Quality Index (AQI) assesses what a proportion of non-current assets (excluding Property, Plant and Equipment) to total assets of the company is. Hypothetically, the significant change within years of this indicator means that the company is trying to pretend less risky than it actually is.

Sales Growth Index (SGI) detect the growth of sales between two years. Initially, the growth of sales does not necessarily mean that there are some manipulations. However, empirical studies prove that the growing revenues are associated with fraud.

Depreciation Index (DEPI) compares depreciation rates between the previous and the current year. If in the current year it is less than in the previous, then it is assumed as the company is trying to report more value.

Leverage Index (LVGI) compares the current year proportion of total debt to total assets and in the previous. The increase in company's leverage might be used to use the debt covenants incentives.

Total Accruals to Total Assets (TATA) shows the extent of cash underlies reported earnings. The less cash there is in the company, the more there is a probability of manipulations.

After the five indexes are calculated, the Equation for the M-Score is the following:

$$M=-6.065+0.823DSRI+0.906GMI+0.593AQI+0.717SGI+0.717DEPI$$

The interpretation of the gathered variable is rather simple: If M-Score is more than -2.22, then the firm can be assumed as a manipulator. (Beneish, 1999)

For the sample companies, the Beneish M model has been calculated for five years, starting from 2010 to 2015. As it has been stated in above, depending on the ending date of the financial year, the numbers may be different from reports dated the same year. In this case, the reader should address to the next year annual report. All the demonstrated calculations have been performed in the Microsoft Excel. (Appendix 2)

The M-score is an independent variable. In this research, the accounting manipulations are seen as a cause of bankruptcy. Consequently, the reason for introducing this variable is to establish any kind of correlation with the Altman Z-score.

Altman Z-score

Very similar to Beneish-M Score, Altman Z-score has been created on the assumption, that the aggregate variable will provide a way more accurate measure of the bankruptcy possibility assessment, then just compare of financial ratios. The method was developed in 1968. (Altman 1968) It has become the revolutionary innovation in financial analysis and bankruptcy

prediction. Even though there are some models that might be more accurate in some situations, Altman Z-score is the most widely used model even nowadays. (Altman 2014, 3)

In this research, the renewed in 1983 model is going to be used. It also consists of some indicators, representing financial ratios.

X1= Working Capital/Total Assets

The first component measures the proportion of the liquid assets in the firm to its total capitalisation. (Altman 1977) It compares the proportion of the company's cash at the specified period of time to all of its assets.

X2 = Retained Earnings/Total Assets

This ratio measures the proportion of the retained earnings of the company to its total assets. It can be interpreted as "how much cash is the firm has in surplus comparing to what it owns at the moment."

X3 = Earnings Before Interest and Taxes/Total Assets

This ratio measures the effectiveness of the company's production. The ratio is useful as it shows the proportion of the operating profit to what the company owns already.

X4 = Market Value Equity/Book Value of Total Liabilities

This market value of the company's equity is determined by investments of shareholders, whereas the debt finance determines the liability value. This ratio shows how fast the company will become bankrupt if its shares decline in value.

X5 = Sales/Total assets

It is also called the Capital-turnover ratio in the financial analysis. It is a measurement of the competitiveness of the firm because it determines the number of sales it can make, hence, the market occupation.

After all the components are calculated, the Z-score for manufacturing and owned firms can be calculated.

$$Z = 0.717X1+0.847X2+3.107X3+0.420X4+0.998X5$$

The results gathered should be interpreted in accordance with this benchmark:

If Z > 2.9, the company is financially robust.

The data for the Beneish M-score calculations has been gathered from the annual reports of the companies. The reader can find all the input data in Appendix 3. The output data can be found in Appendix 1.

Beta

Beta measures the responsiveness of returns on an asset to the market fluctuations. (Hundal, 2017) It can be calculated with the formula in the Picture

$$\beta = \frac{\text{Covariance of Market Return with Stock Return}}{\text{Variance of Market Return}}$$

Figure 3.20. Beta Coefficient Formula (Obaidullah 2012)

The covariance is a metric used for the statistic analysis to show how two variables change comparing to one another. (Investopedia 2017)

So firstly it measures how the return on the market index is different from the company's return.

The variance is a statistical concept that shows how wide the specific numbers are spread. Logically, the more prominent price fluctuations are within a specific time period, the riskier the asset is. (Investopedia 2017).

Consequently, the beta measures how the company's stock return is different from the market return. The more the beta is, the riskier is the company. The beta interpretation can be found in the Table 3.2.

Beta = 1	The stock has the same volatility rates as the market. Same return and loss rates as the market growth or decrease rates

Beta > 1	The company's share price is more volatile than the market. Higher return or loss rates than the market growth or decrease rates
Beta < 1	The company's share price is less volatile than the market. Lower return or loss rates than the market growth or decrease rates
Beta < 0	The stock is in the negative correlation with the market. If the market grows, the stock will go down and vice versa

Table 3.2 Beta coefficient interpretation. Adapted from Goyal & Joshi (2012).

In this research, the beta calculations have been done with the use of the Microsoft Excel. The calculations' process can be seen below.

1. Downloading the historical prices of all the companies and the FTSE100 index from the 01.01.2010 to 31.12.2015. The stock prices have been downloaded from the commercial databases of Yahoo Finance and Google Finance.
2. Calculation of the return on the market and each company stock by subtracting the current price from the previous and dividing it by the previous price.
3. Applying the function SLOPE in the Microsoft Excel for the stock prices return of a company and the market return.

The beta has been calculated on the historical basis. It means that for the year 2010 the data set was taken from the 01.01.2010 to 31.12.2010. For the year 2011 it the data set was calculated from the 01.01.2010 to 31.12.2011. Every year the starting point was the 1st of January 2010 and ending with the 31st of December the year studied. This approach allows generating the most reliable data for each year. The beta calculations are presented in the tables with the results of the company-based analysis.

Standard Deviation

The standard deviation measures how the dataset deviates from its average mean. The standard deviation is a square root of the variance, that was

explained in the previous part. The Picture represents the formulas for calculating the variance and the standard deviation.

$$Variance = \frac{\sum(return - mean)^2}{N}$$

$$Standard\ Deviation = \sqrt{Variance}$$

Figure 3.21. Variance and Standard Deviation formulas.

For this research, the standard deviation has been calculated using the Microsoft Excel using the same market data and the same approach as with the beta calculations. The stock price change has been taken for the company on the historical basis. After, the function STDEV is applied.

Disclosure of used components in variables calculations

The role of this part is a glossary of all the used financial terms in the calculations.

Beneish M-score calculation components

- Receivables – The unfinished transaction or a financial obligation owed to a company by other parties. Receivables are reported in the balance sheet of the company. For the calculations, only the current (expire in less than one year) receivables are used.
- Sales – the account for all the revenue gathered from the operations of a company. Sales are the first line in the income statement in the financial reports.
- Cost of Goods Sold (COGS) – the account for the expenditure on the material used in the production of all the goods sold by a company and cost of labour that was needed to make a product. This account does not include the administrative and distribution costs. COGS is reported in the income statement, right after the sales statement.

- Total Assets – all the items that bear economic value for the owner. Assets is what the firm own, so it also includes debts that the firm has. This statement is reported in the balance sheet.
- Current Assets – an account that state the value of company's assets that can be converted into cash during one year. It is a balance sheet statement.
- Property, Plant and Equipment (PPE) – a tangible fixed asset of the company, representing the economic value of the machinery needed for operations. PPE is usually tough to convert into cash. Thus it is considered as a non-current asset.
- Depreciation – a non-cash transaction and is not included in the cash flow. It is the method which is used for the companies to write off the cost of a tangible asset. For example, an estimated life of a tangible asset is 10 years. Writing off its value in one year would show that there is a significant loss of the assets. Instead, the cost of an asset will be writing off every year by the sum equal to 10 percent of the original price. Depreciation expenses account is reported in cash flow statements.
- Sales, General and Administrative Expenses (SG&A) – this account represents the value spent on daily operations but not directly related to the production, such as warranty costs, logistics costs, etc. SG&A are reported in the income statement.
- Long-term Debt (LTD) – financial liability of the company that the company will bear for more than a year. Long-term debt can be found in the non-current assets as "borrowings".
- Current liabilities – financial obligations of the company that it must cover within one year. Current liabilities are usually reported in the balance sheet.
- Cash – the most liquid account of the firm. It includes the cost of securities that can be converted into cash within two days. The cash account can be found in the current assets in the balance sheet statement.

Altman Z-score calculation components (those that were not explained in the Beneish M calculation components)

- Working Capital – is a financial ratio that measures the effectiveness of company's operations. It is calculated by subtracting current liabilities from current assets. It shows if the company have enough resources to pay its short-term debt.
- Retained Earnings – the account that represents the proportion of the net profit of the company that have not been paid as dividends to the shareholders but kept in the turnover for investment into new projects or for paying firm's liabilities. It can be found by subtracting the dividends from the net profit of the company.
- Net Profit – the account representing the final economic value of the company's operation after paying the income tax. Usually, it is the last line in the income statement of the financial report.
- Earnings Before Income Tax (EBIT) – an account representing the final economic value of company's operations before the income tax has been paid. Also referred as operational profit. Reported in the income statement after the subtraction of COGS and SG&A from total sales.
- Market Value of Equity – the economic value of the shareholder's equity. Calculated by multiplying the number of shares issued by the share price. For the calculations the share price t the end of the reporting period has been used.
- Book Value of Total Liabilities (total liabilities) – the account representing the economic value of everything the company owes to the investors. Total liabilities represent the debt of the company. It is reported in the balance sheet statements.

4 Results

For generating the best quality of the results, two kinds of analysis have been used. The first one discloses results on each company's performance. It is essential for showing the influence of the performance and the industry level affection. Also, it removes the bias from the common perception of the picture that the statistics analysis provide. In the company's analysis, there are graphical outputs presented for each case. The graphics are based on the

tables the reader can find in Appendix 1. All of the data analysis has been performed using the Microsoft Excel.

The second analysis is statistical analysis made with SPSS. This tool has been used to quantitatively assess the links between variables and assess how the findings are relevant. This statistic analysis provides statistical evidence that can prove or disprove the hypothesis of this research. Nevertheless, it cannot provide the insight on each case separately.

4.1 Analysis by company

The goal of this type of analysis is to present findings on each company separately and monitor how the output changes depending on the type of a company. It helps to answer the central question of the research whether there is a relation between the accounting manipulations and the probability of bankruptcy. In each case, the suggested idea will be highlighted. At the end of this analysis, the researchers will present their joint findings in Table 4.1.

A1: Dunelm Group Plc

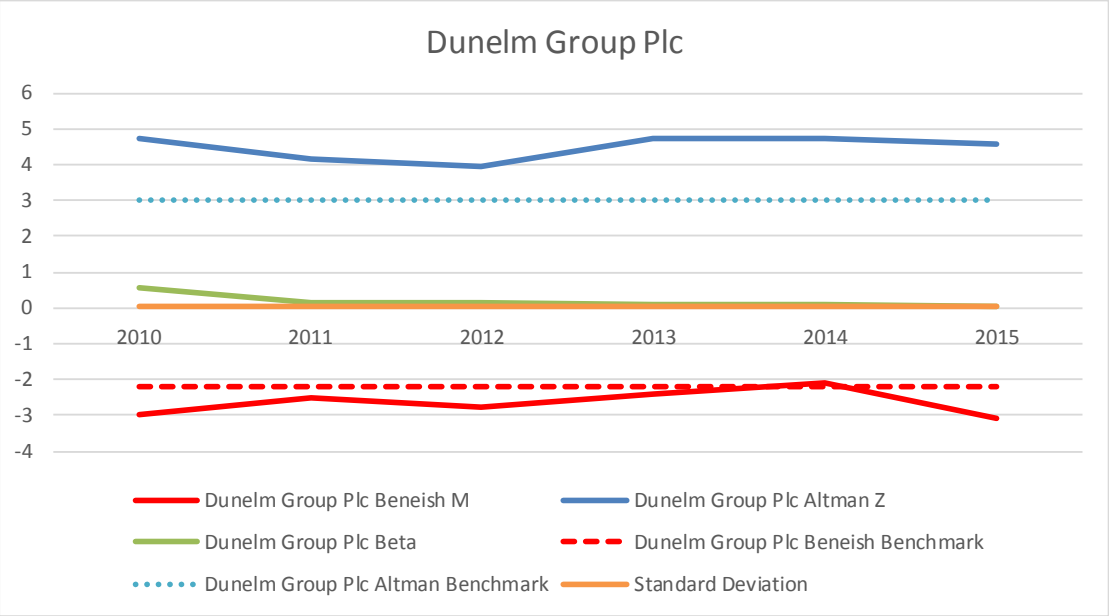

Figure 4.1 Dunelm Group Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of Dunelm Group Plc most of the time has been slightly below its benchmark, however, in 2014, it crossed the line. It means that the company is unlikely to be a manipulator except for the year 2014.

The Altman Z-score of Dunelm Group Plc during the studied period remains far above its benchmark, which reflects the fact that the company on the market is considered high-performing and is not likely to become bankrupt.

The Dunelm group's Beneish and Altman curves correlate positively (except for the year 2011) It shows that the lower the Beneish M-score, the lower is the Altman-Z. For Dunelm Group, *the less the extent of the accounting manipulations is, the more the probability of bankruptcy is*.

A1: WH Smith Plc.

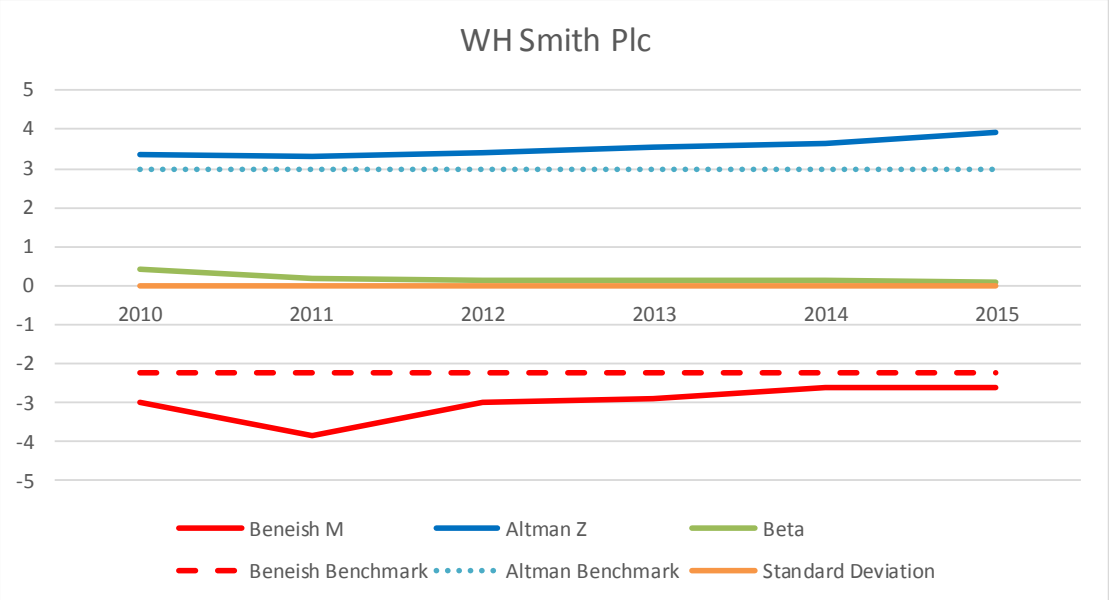

Figure 4.2 WH Smith Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

Beneish M-score of WH Smith always remains below its benchmark, which shows that WH Smith is unlikely to be a manipulator. In 2011 there is a drop that can be explained by WH Smith's significant decrease in administrative expenses. (See Appendix 2)

Altman Z-score in the years 2010 and 2011 remain very close to its benchmark but after demonstrate slight but confident growth. It means that within five years the probability of bankruptcy has become lower. It is not

surprising because also WH Smith is a high-performing company on the market.

Except for the fall of Beneish M 2011, Altman and Beneish curves correlate positively during all the studied period. It makes truth the assumption *that the greater the extent of manipulations is, the less likely the company is to be bankrupt.*

B1: Associated British Foods Plc

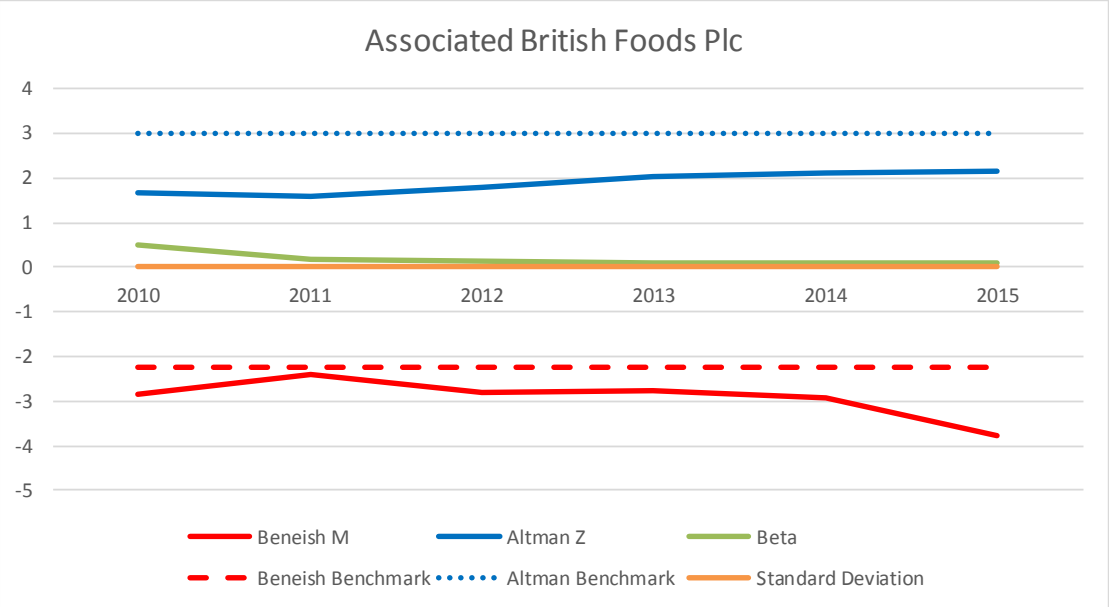

Figure 4.3 Associated British Foods Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

During the studied period the Beneish M-score has been falling except for the year 2011, when there was a slight raise from -2.8 to -2.3. At this moment the extent of accounting manipulations has been almost -2.22, and in this case, it would be possible to call Associated British Foods a manipulator.

The Altman Z-score of Associated British foods is below its benchmark. It means that the company is not as stable as the market perception. However, it is not reflected on the beta curve, which means that the risk is not coming from the market.

For Associated British Foods it would have been fair to say that *the more company manipulates its account, the less likely it will face bankruptcy.*

However, it is not so because the Altman' variable suggests it is already not as robust as it seems.

B1: Cranswick Plc

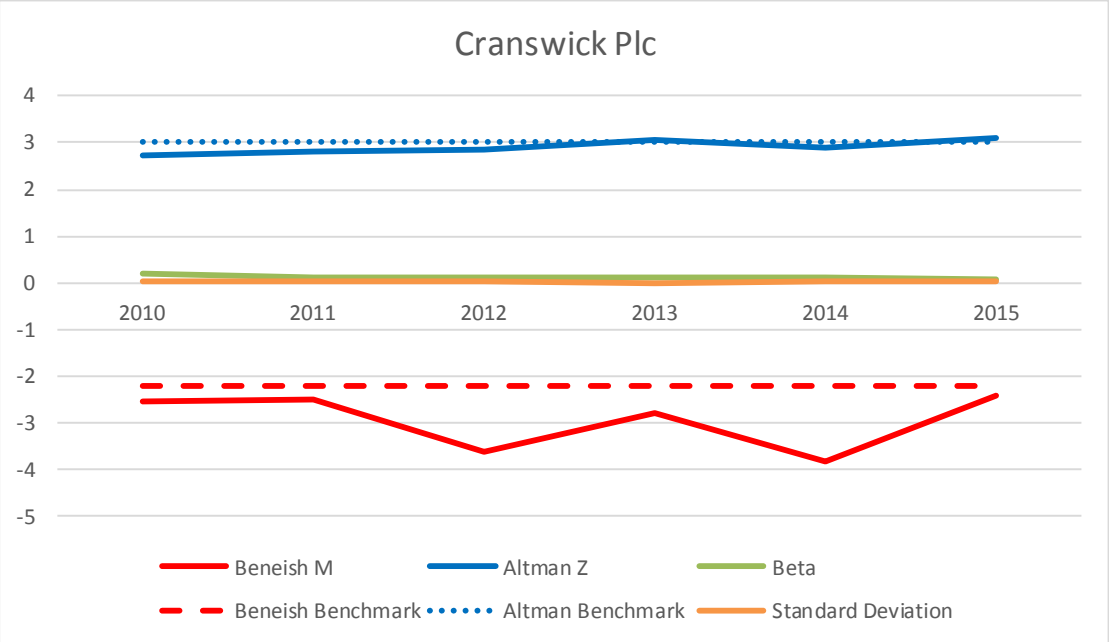

Figure 4.4 Cranswick Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score has been suffering significant fluctuations within five years. It is below the critic line, but in 2015 has come really close to it, accounting for -2.4. Cranswick is not considered as a manipulator.

Figure 4.4 represents the stable position of Cranswick's Altman Z-score. During the studied period, it is going almost always on the line with its benchmark, which suggests that the probability of company's bankruptcy is pretty high. However, despite slight changes, there is an overall growth from 2.7 in 2010 up to 3.08 in 2015, which is also the minimum and maximum points.

From the Figure 4.4 one can notice that even if the change in the Altman variable is not crucial, the less is the Beneish, the lower is the Altman. It leads to the idea that for Cranswick Plc *the accounting manipulations help to keep the company far from bankruptcy.* At the same time, the Altman's curve is stable, and the Beneish's is a fluctuation, that leads to the assumption that it is

possible that *there is no dependence of bankruptcy on the accounting manipulations.*

C1: E2V Technologies Plc

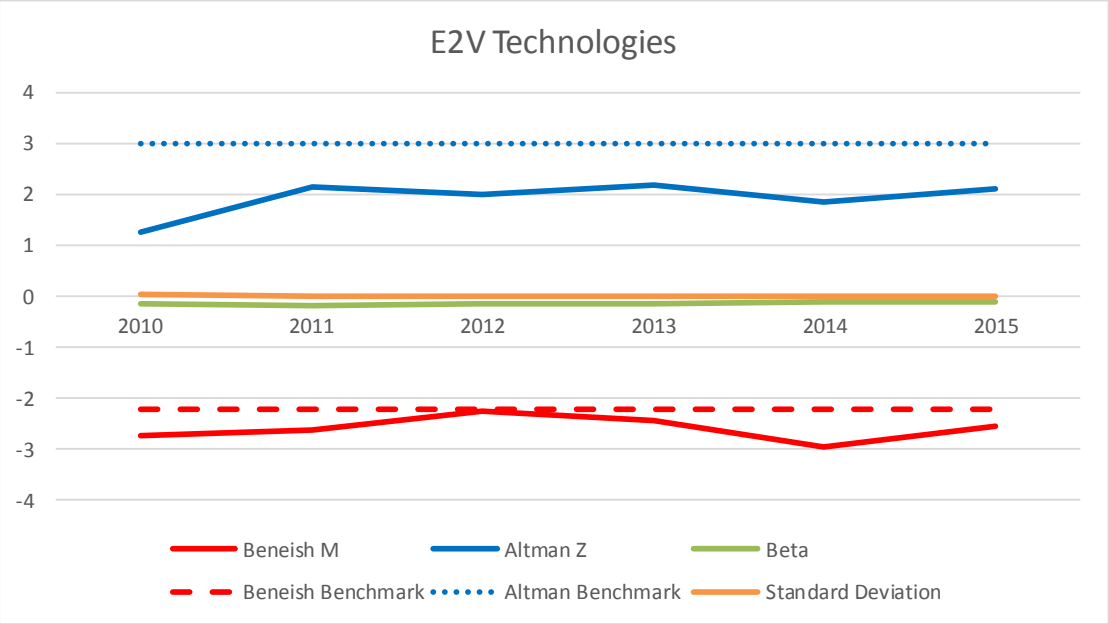

Figure 4.5 E2V Technologies Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

E2V Technologies' Beneish M-score remains below the benchmark except for the year 2012. It means that the company applied the accounting manipulations only in 2012.

The Altman's score is also below its benchmark, however, in this case, it means that the company's position is not very stable despite its high market performance. During the studied years, it improved only in 2011, from the point of 1.2 to 2.1. In the following years, it was experiencing stagnation.

It is impossible to establish any significant correlation between Altman and Beneish variable of E2V. Thus, it would be correct to state that *the probability of bankruptcy is not affected by accounting manipulations*.

C1: Halma Plc

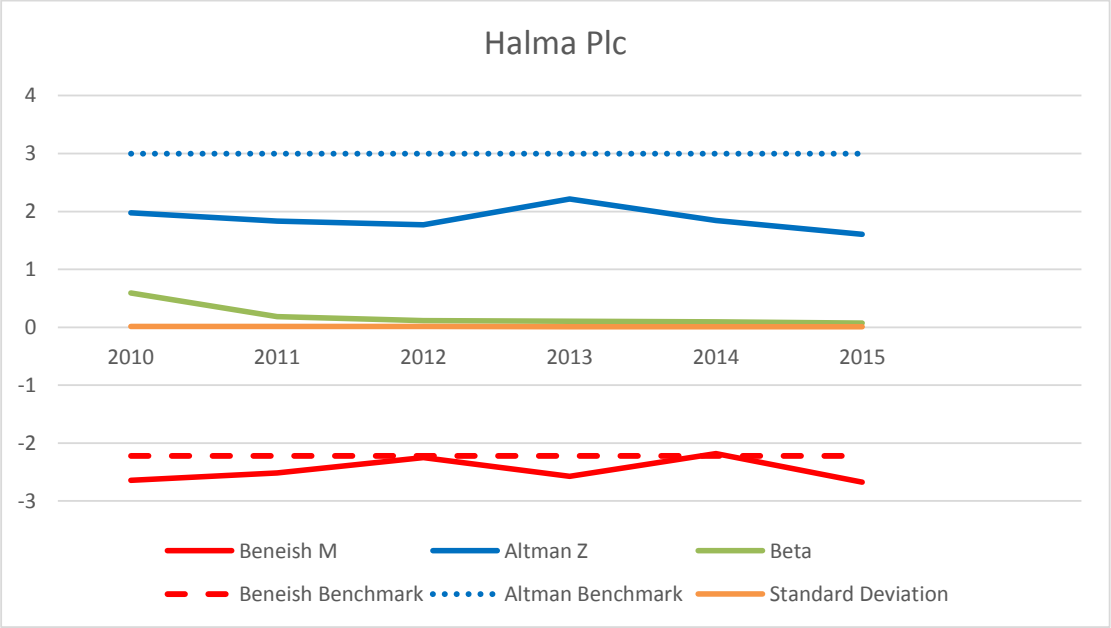

Figure 4.6 Halma Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score for the Halma Plc remains below the critical line most of the time, but still close to it and twice, in 2012 and 2014 the earning manipulations have been detected. It gives the idea that the Halma's managers are not usually totally honest with their stakeholders. Overall, the Beneish index remains stable.

The Altman Z-score is below its benchmark, which means that despite the fact that the company is high-performer on the technologies market, it does not reflect its financial health. During the studied period, the index is stable and reaches its maximum in 2013, accounting for 2.21.

Before 2014, the reader can notice that the curves have a negative correlation. Thus, for the majority of the studied period the assumption that *the more the extent of manipulation, the more is the probability of bankruptcy*. The example of Halma Plc proves the opposite of the Dunelm group.

A2: Kingfisher Plc

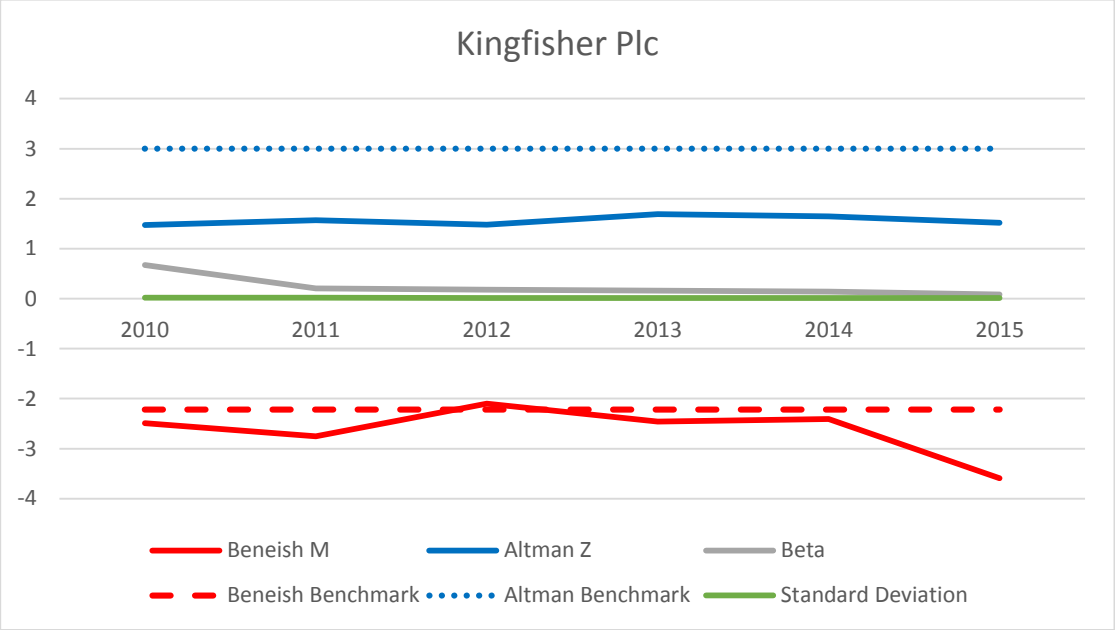

Figure 4.7 Kingfisher Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

Kingfisher Plc is opening the next group of companies sorted by the level of performance – well-performing.

The Beneish M-score is always close to the critical line, and in 2012 it crossed it. The minimum was reached in 2015, accounting for -3.6. The results of Kingfisher could be assumed as risky.

The Altman Z-score is highly stable. The numbers vary from 1.4 to 1.6 during the five years. It could be explained by the fact that Kingfisher is an old company. However, the result is below the Altman's benchmark.

There is no correlation between this two curves. Thus, the Kingfisher's example proves that *there is no dependence of bankruptcy on accounting manipulations*.

A2: Marks and Spencer Group Plc

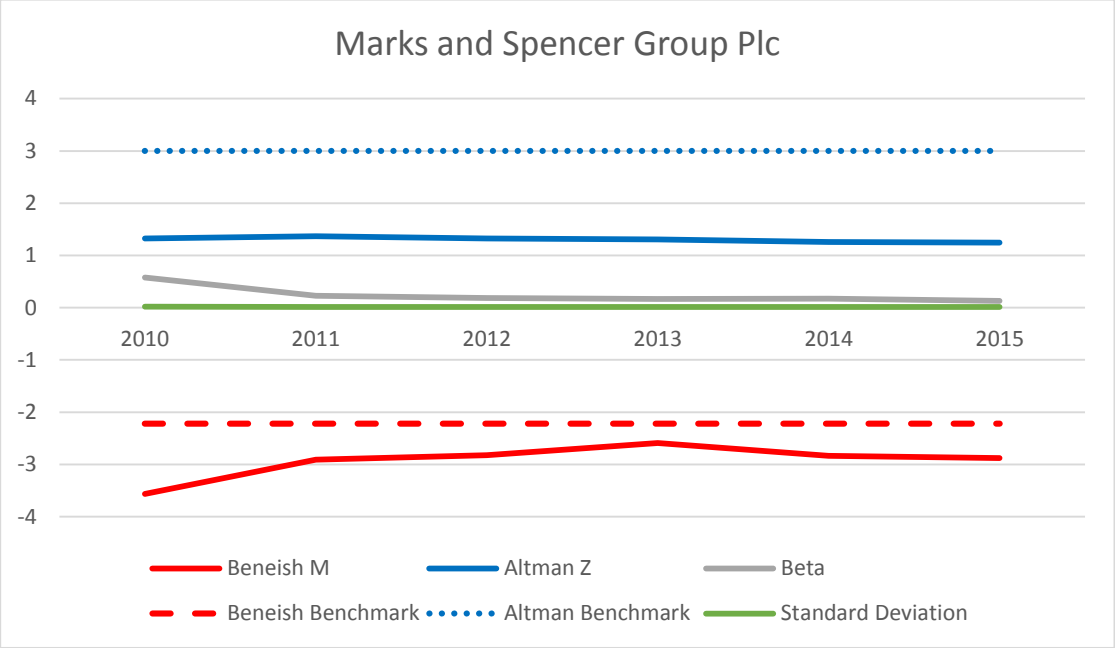

Figure 4.8 Marks and Spencer Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of Marks and Spencer is always below the critic line during the studied period. It has been slightly increasing between 2010 and 2013 from -3.5 to -2.5. After, there was a decrease down to -2.8. Marks and Spencer cannot be considered as a manipulator.

The Altman Z-score is stable during the five years. It varies from 1.3 to 1.2. It means that the same as Kingfisher, an old-established company is keeping the stable position. However there this position is below the benchmark established. Perhaps, this can be an explanation why such a famous and robust company is considered not as a market performance star.

There is no correlation between the Altman and Beneish curves. Consequently, it can be assumed that the example of Marks and Spencer *disprove the dependence of bankruptcy probability on accounting manipulations*. At the same time, both stable variables indicate that the *company's insolvency is likely, but it could be because it does not apply accounting manipulations*.

B2: Devro Plc

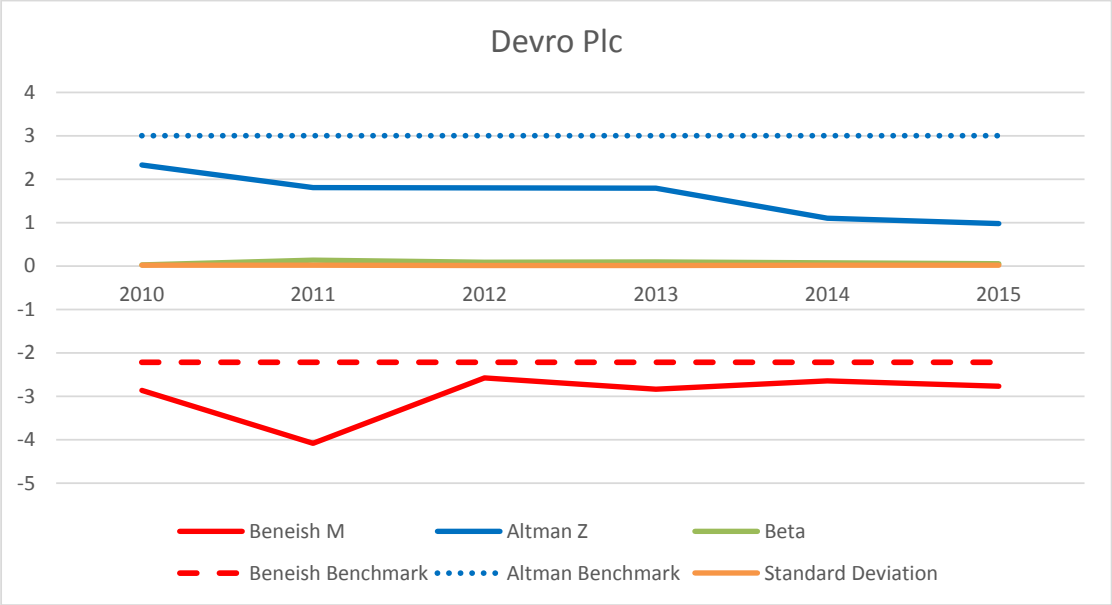

Figure 4.9 Devro Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

Devro Plc cannot be considered as a manipulator because the Beneish M-score is remaining below the critic line. Except for the year 2011, it has been very stable. The reason for a sudden drop is an increase in the Property, Plant and Equipment of Devro that has been very well reflected by the increase of its total assets.

The Altman Z-score during the studied period is falling continuously. In 2010 it was 2.3 and ended up in 2015 with the number of 0.9. Also, the curve is below the benchmark, which suggests that the financial health of Devro can be severely affected.

There is no correlation in-between the two variables of Altman and Beneish. Thus, the example *disproves the assumption of the dependence of bankruptcy on accounting manipulations*. However, it might also be that the company that *experiences terrible times precisely because it shows actual figures.*

B2: Tate and Lyle Plc

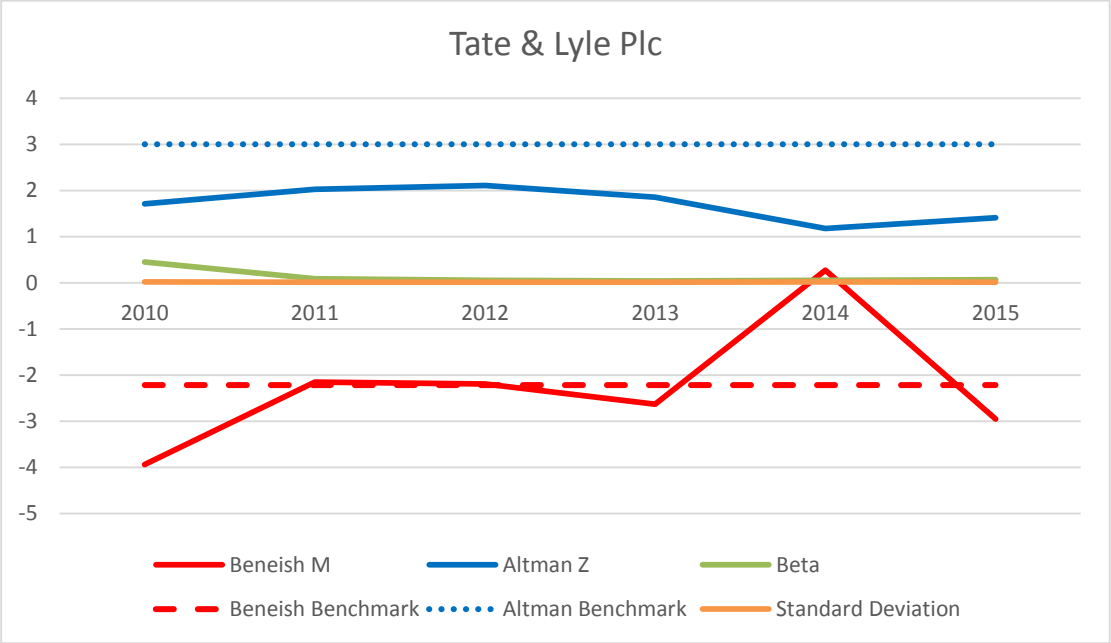

Figure 4.10 Tate & Lyle Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of Tate and Lyle clearly indicates that the company manipulates its accounts. The sudden rise of the Beneish M-score in 2014 can be explained by the fact, that in 2013 the company has a decrease in sales from €3.2 million in 2012 to €2.4 million in 2013 and €2.3 million in 2014. However, the problem is that the costs of sales remained only slightly changed – €2.5 million in 2013 to €2.3 million in 2014. Overall, the index majority of the time is on the critic line or above (2011, 2012, 2014)

The Altman-Z score is also below its benchmark, which again is a sign of problems inside the company. It has been slightly fluctuating for five years. An interesting thing that it reaches its minimum when the Beneish M-score is at its peak, accounting for 1.1. However, it is below the benchmark, and it questions the financial health of the company.

It is impossible to say that there is a significant correlation between Altman Z and Beneish M, except the case in 2014. That is why the results show that *there is no dependence of bankruptcy on accounting manipulations.* At the same time, the Tate&Lyle's case can show that *a company that is a manipulator have a high probability of insolvency.*

C2: Univision Engineering Plc

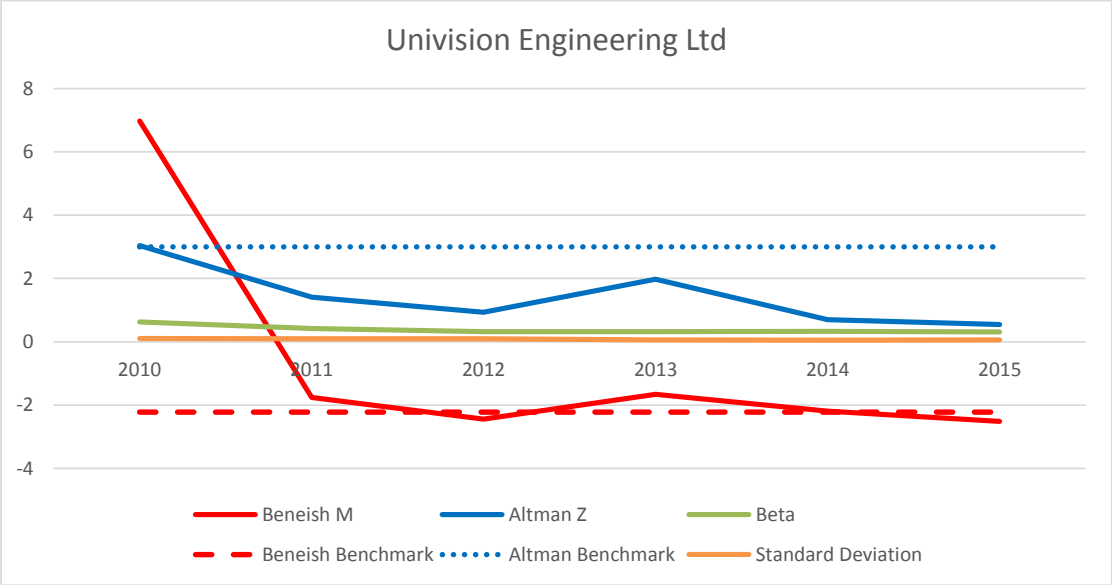

Figure 4.11 Univision Engineering Ltd Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score curve is fascinating in the case of Univision Engineering. The Figure 4.11 shows that in 2010 it was accounting for 7, which is an extremely high point. It can be explained by the fact that in 2009 Univision Engineering had €6 million of total assets and in 2010 it was reported a number of €17 million, without a significant increase in profit and with a decreased number for Property, Plant and equipment. Nevertheless, even without this suspicious peak Univision Engineering is a manipulator because the majority of the time its Beneish variable is above the critic line.

The Altman Z-score of Univision Engineering was on the borderline of a benchmark in 2010, accounting for 3. However, within five years, it was falling to 0.5, which means that the financial stability of the company can be questioned.

The case of Univision Engineering proves that there is a dependence of bankruptcy and accounting manipulations because the two curves correlate positively. This case states for the idea that *the more the extent of accounting manipulations, the more bankruptcy is probable*.

The beta variable is decreasing within the period starting from 0.6 in 2010 and ending at 0.3 in 2015. Comparing to all the previous companies examined son far, Univision Engineering has the highest rate of vulnerability in the market.

C2: Spectris Plc

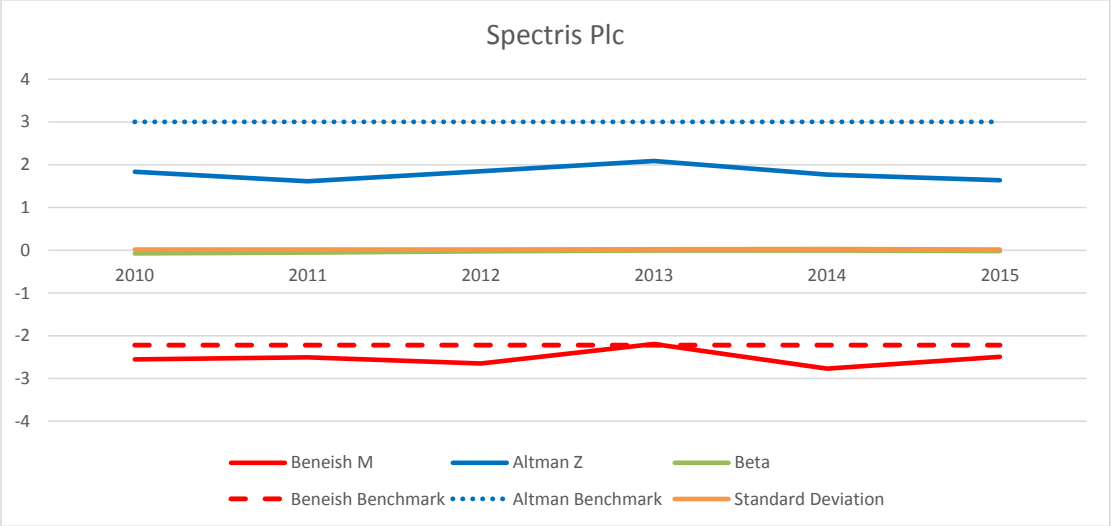

Figure 4.12 Spectris Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score is relatively high and crosses the critic line once during the studied period. It means that the company was manipulating its accounts in 2013.

The Altman Z-score of the Spectris Plc is below its benchmark. It indicates that the company is likely to be insolvent. At the same time, this indicator during the studied period does not change significantly, which means that this position is typical for Spectris Plc.

Since peak for the Altman Z variable was in 2013, accounting for 2. It was also the peak of the accounting manipulations when the Beneish M was 2,19. It would be correct to say that *the more the company is manipulating its accounts, the less likely it will face he insolvency*.

A3: Debenhams Plc

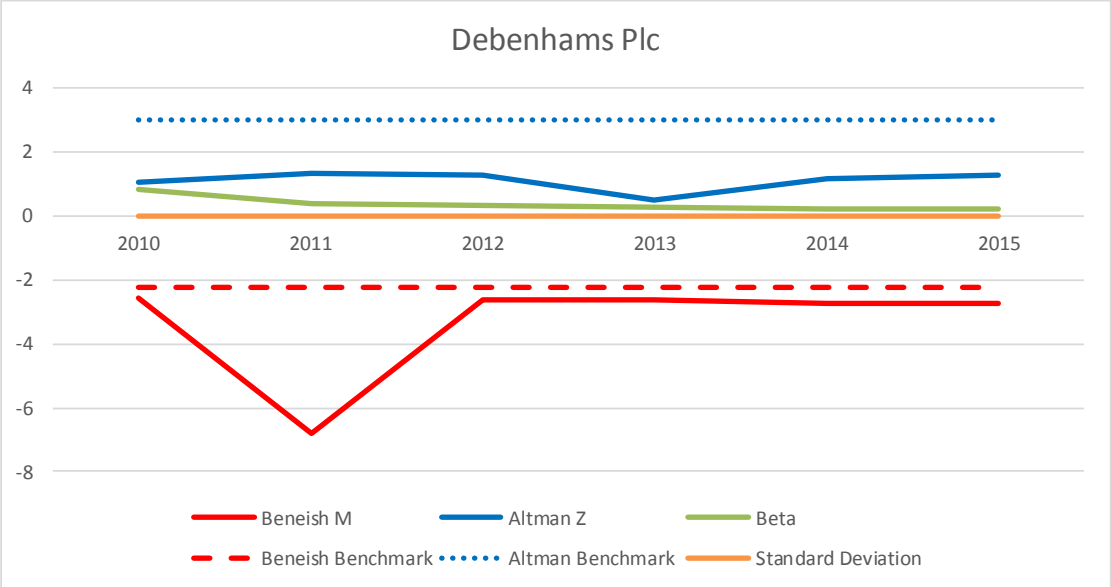

Figure 4.13 Debenhams Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

Beneish M-score of Debenhams Plc remains stable except for the year 2011 when one can see s sudden drop. The researchers cannot explain this by the data presented in the calculations. Nevertheless, Debenhams Plc is not considered as a manipulator, because its Beneish variable has never been more than -2.22, which is a benchmark for the index.

The Altman Z-score is very low for Debenhams, varying between 1.3 (2011) and 0.4 (2013). It is significantly less than the Altman's benchmark. Thus the company is considered not financially stable.

There Figure 4.13 does not reflect any correlation between Altman' and Beneish' curves. It can be assumed, that there is *no dependence of bankruptcy on the accounting manipulations*. However, since the Altman's curve is below the benchmark, it is also true to say that *the probability of bankruptcy is seen as high because the company does not manipulate its accounts.*

A3: Stanley Gibbons Group Plc

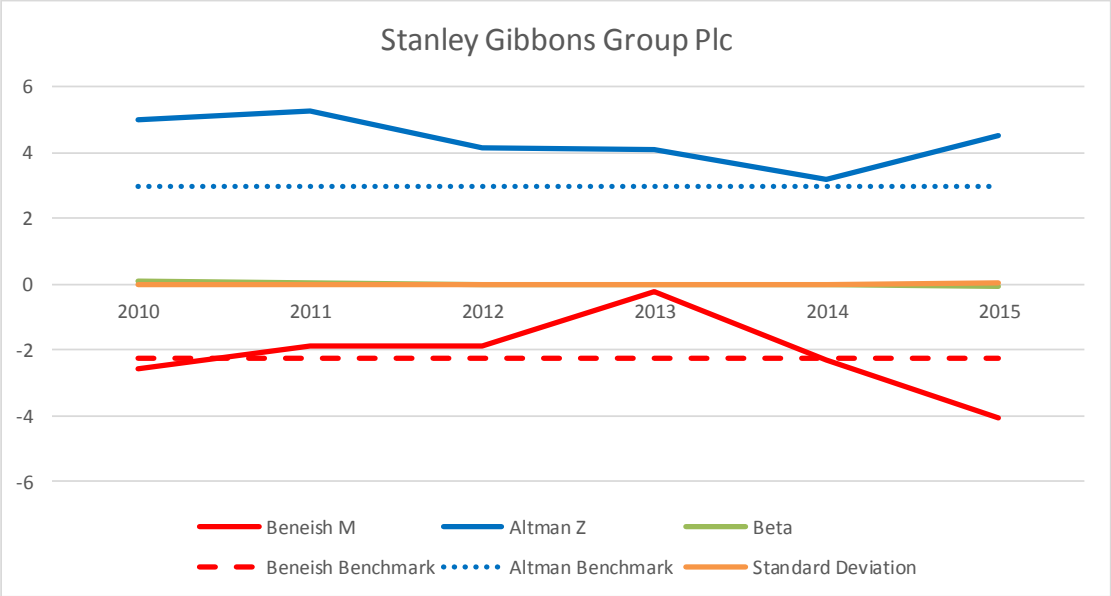

Figure 4.14 Stanley Gibbons Group Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of Stanley Gibbons Plc majority of the time is above its benchmark, which means, that the company can be assumed as a manipulator. From the beginning of the studied period, the curve is increasing and reaches its peak in 2013, accounting for -0.2, which is significantly higher the reasonable level. From 2013 to 2015 the curve is decreasing returning down to -4.

Stanley Gibbons is the second company in this research that has an Altman Z-score above the critic line. It represents that the company is financially robust. It reaches its lowest point in 2014, which is 3.2.

There is no correlation between the two curves representing the Altman' and Beneish' variables. However, the example of Stanley Gibbons suggests that *if the company is applying the accounting manipulations, it is less likely to be bankrupt.*

B3: R. E. A. Holdings Plc

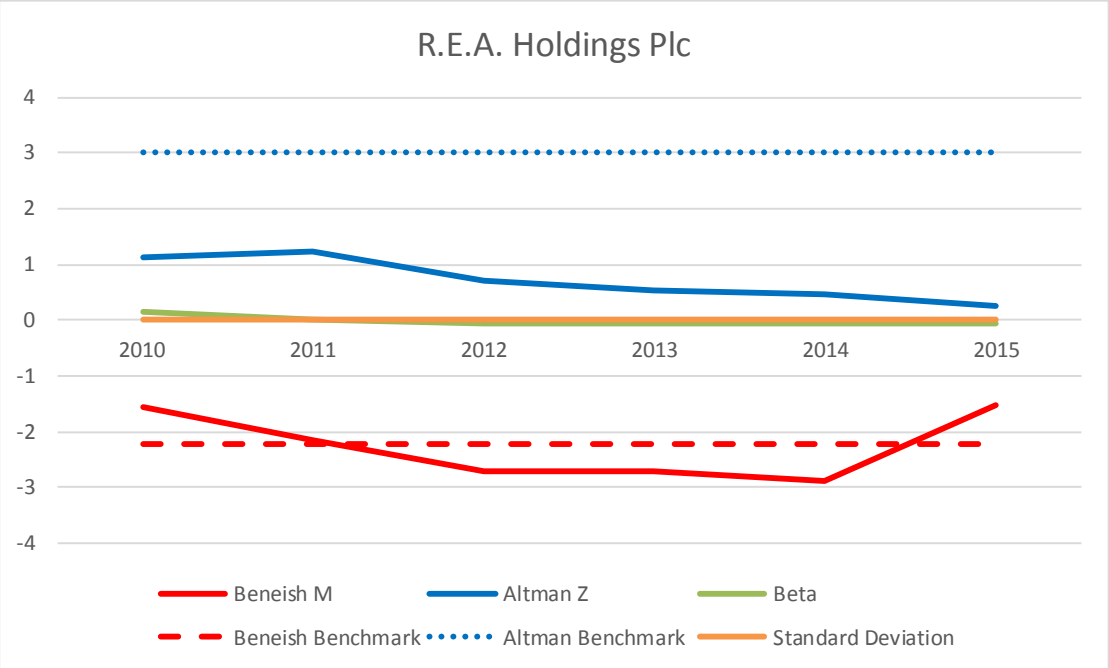

Figure 4.15 R. E. A. Holdings Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of the R. E. A. fluctuate from -1.5 (2015) to -2.8 (2014). There are no sudden peaks or drops, however, for the years 2010, 2011 and 2015 the indicator was above the Benchmark. It allows assuming that R. E. A. applies accounting manipulations.

The Altman Z-score has been decreasing during within five years. Although in 2011 there was a slight growth, it was followed by a gentle drop down to 0.2 in 2015. It indicates that the company's likelihood of bankruptcy is very high.

What is more, Altman variable matches with the maximum of Beneish. However, the period between 2011 and 2014 represents the positive correlation between the two curves. The example of R. E. A. *suggests that the less a company manipulates its accounts, the more the probability of bankruptcy is.*

B3: Premier Foods Plc

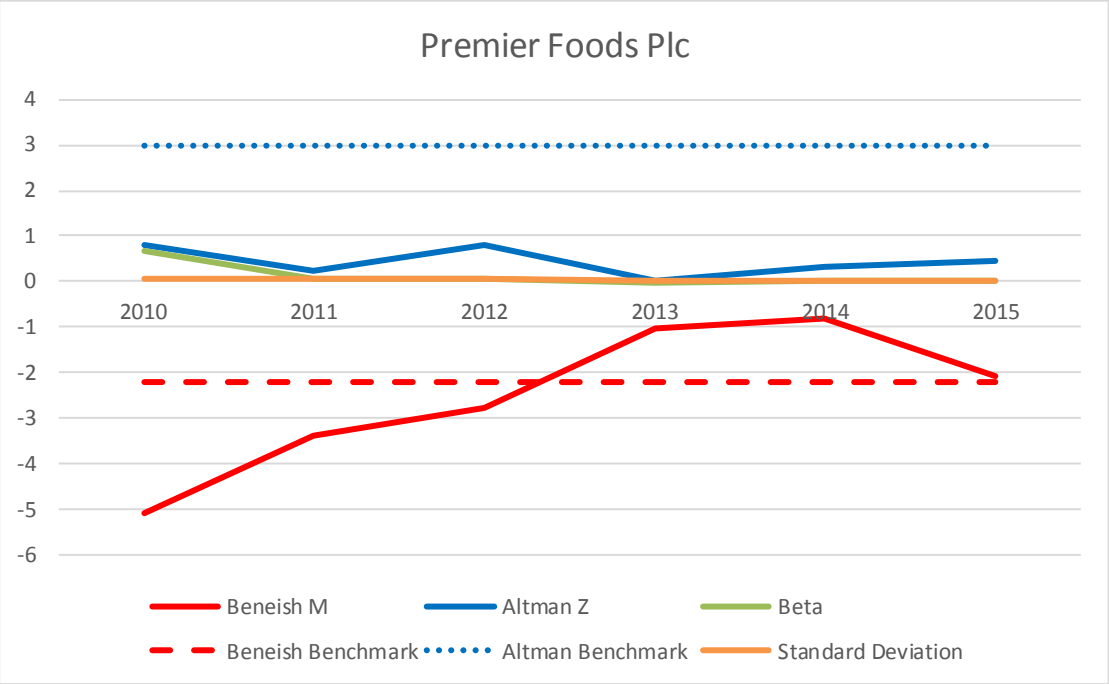

Figure 4.16 Premier Foods Plc Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of Premier Foods is raising significantly from 2010 to 2014 from -5 up to -0.8. In 2013 the curve crossed the benchmark. Thus, the Figure 4.16 leads to an assumption that the Premier Foods is a manipulator since 2013.

Altman Z-score is critically low. In general, it did not improve or fallen dramatically within five years but has experiences some fluctuations. In 2013 the variable reached its minimum accounting for 0.3. The financial health of the company is critically low.

There is no correlation between the two curves. Thus, Premier Foods case proves that there is *no dependence of bankruptcy on accounting manipulations*. Nevertheless, the company is *likely to be bankrupt and is considered as a manipulator*.

C3: Artilium Plc

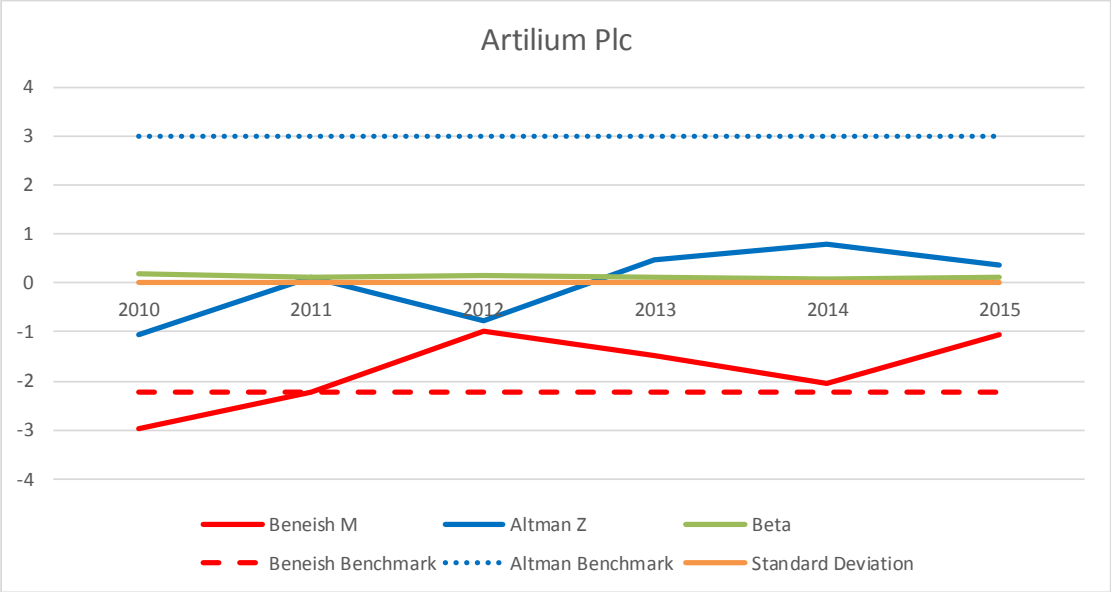

Figure 4.17 Artilium Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M score of the Artilium Plc after 2011 has been above the critic line, which indicates, that Artilium's managers are manipulating its accounts. The lowest point was in 2010, accounting for -2.9, which was still normal. However, after that, it increased and reached its maximum in 2012, with the number of -0.9.

The Artilium's Altman Z-score is the lowest among the whole sample of companies. In 2010 it had its minimum at -1, and the maximum was reached in 2014, accounting for 0.7. It is remarkably lower than the established. benchmark

There is no significant correlation between the two curves. However, the company is very vulnerable, and also it applies accounting manipulations. The researchers think that this case *proves the dependence even though there is no correlation.*

C3: Oxford Instruments Plc

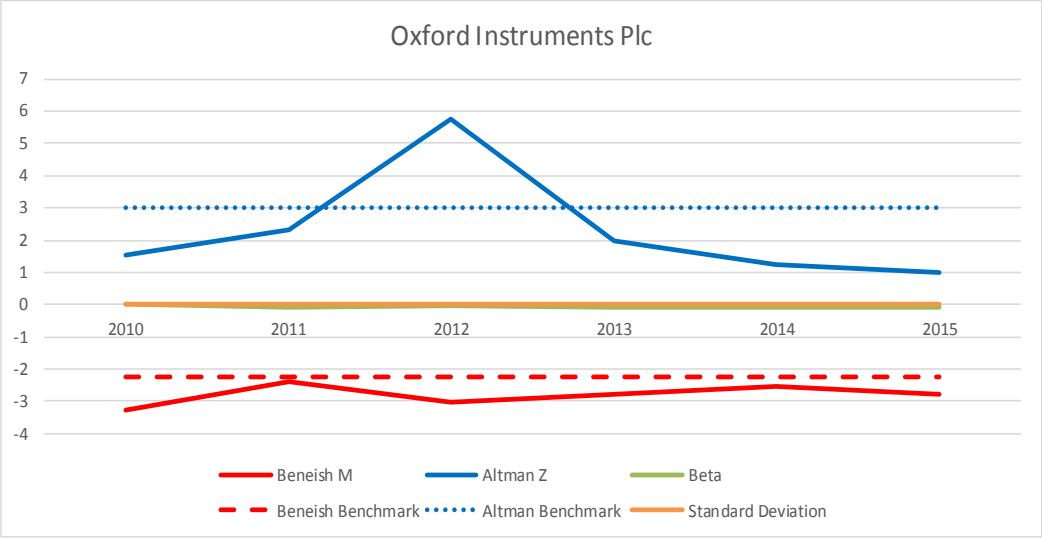

Figure 4.18 Oxford Instruments Plc Beneish M, Altman Z, Beta and Standard Deviation curves fluctuation within 2010-2015

The Beneish M-score of Oxford Instruments is stable during the studied period. It keeps close to the critic line, however, does not cross it. The variation of the curve is from -3.2 (2010) to -2.4 (2011). Artilium Plc is not considered as a manipulator.

The Altman Z-score, most of the time, remains below that benchmark established. However, in 2012 there is sudden increase up to 5.7. The peak was followed by a dramatic decrease back to 1.9 in 2013. The variable reaches its minimum by 2015 with the number of 1.0. Overall, the probability of bankruptcy is increasing for the Oxford Instruments.

The two curves do not correlate. Since there was no significant change in the Beneish M-score and the company is not a manipulator, this particular case proves that the *probability of bankruptcy is not dependent on accounting manipulations.*

Overall findings

Majority of the companies in the used sample have an Altman Z-score below its benchmark, which means that they are all likely to face bankruptcy. It makes the analysis more difficult. The assumptions about the findings could be based on two principles: correlation between the curves and their position to the benchmark. Since the Altman Z-score is almost always below its

benchmark, even if there is any kind of correlation, it might not match with an assumption based on the position towards benchmark.

For example, the company has a positive correlation of Altman and Beneish' variables, which suggests that the more the accounting manipulations, the less likely the company will become bankrupt. However, its Beneish M-score is above the critical line, and Altman Z-score says that it has problems with solvency. This gives an opposite suggestion: the company is a manipulator, and it is likely to face bankruptcy.

There were only three companies, whose Altman Z-score was higher than the critical line. They were the Dunelm Plc, WH Smith Plc and Stanley Gibbons. Their codes are the following ones:

A1, A1, C1.

Firstly, this finding means that retail industry is the most reliable one regarding the probability of bankruptcy. Secondly, Dunelm and Stanley Gibbons are manipulators. It confirms the confirms the idea of this work that there is a relation between the probability of bankruptcy and the extent of accounting manipulations. However, it shows that if the company is solvent, regardless of its industry and market performance, it applies the accounting manipulations.

For some companies, it is correct to say that the more the company is applying the accounting manipulations, the more is the probability of bankruptcy. On the other hand, some of the cases suggest that the more is the extent of manipulations, the less is the probability of bankruptcy. Some cases fall into the category of companies that deny the dependence of bankruptcy on accounting manipulations.

Idea	*"the more the extent of accounting manipulations, the more is the probability of bankruptcy."*	*"the more the extent of accounting manipulations, the less is the probability of bankruptcy."*	*"There is no dependence between accounting manipulations and the probability of bankruptcy."*
Companies*	A1, C1, B2, C2, B3, C3	A1, B1, A2, B2, C2, A3, A3, B3	B1, C1, A2, B2, B2, A3, C3

Amount**	6	8	7

Table 4.1 The overall analysis of the ideas suggested by the 18 cases of studied companies

* Only the codes are included in the table because presenting the names of companies does not reflect the critical information. Only the types of the companies matter for analysis.

**Some of the cases fall into two categories at the same time – no dependence and one of the others is possible.

Table 4.1 proves that it is impossible to establish any dependence of the accounting manipulations on the probability of bankruptcy.

The third objective of the research was to detect that the low-performing companies are more likely to be a manipulator. According to our findings, only seven companies out of 18 have not been presenting artificial earnings. Those codes are:

A1, B1, B1, A2, B2, A3, C3

The codes of the manipulators are:

A1, C1, C1, A2, B2, C2, C2, A3, B3, B3, C3

Based on this findings one can state, that the level of the manipulations is the lowest in the retail industry. The tech industry is undoubtedly the riskiest one regarding probability of artificial earnings

Most of the companies that appeared not to be manipulators are the high-performing companies. However, it is impossible to make an assumption, because the proportion of high performing manipulators is 50 percent. The frequency of manipulation detection increases with the decrease of the performance level. Nevertheless, it is impossible to say that the low-performing companies are more frequent manipulate accounts.

4.2 Statistics Analysis

The statistical analysis Appendix 4 contains one dependent variable, which is the Altman-Z score. Beneish M-score, beta and the standard deviation are the independent variable. This setting has been established to study the impact of

accounting manipulations, market risks and internal risk on the probability of bankruptcy.

From the descriptive analysis, the reader can conclude, that the majority of sample companies have an Altman-Z score 1.9. It means that most of them are likely to be bankrupt because the benchmark established for this variable is 2.9. The mean for Beneish M-score is -2.5, which indicates that on average the sample companies cannot be considered as manipulators because the Beneish M-score should not exceed -2.2. The average beta variable is 0.1, which indicates that the companies are slightly affected by the systematic risk. On average companies respond by 10 percent to the changes in the market.

The Pearson correlation indicates how the variables behave together and if there is some typical pattern in their curves.

The correlation between the Altman and the Beneish scores of all the sample companies is -0.014. (See Appendix 5) The number is close to zero, which means that the Beneish M-score does not influence the Altman Z-score and that there is no dependence of bankruptcy on the accounting manipulations. Since the number is negative, it means that it is more likely that the growth in Beneish M-score defines the fall in Altman Z-score, which supports the first idea of the research that the accounting manipulations have a negative impact on the probability of bankruptcy. Nevertheless, the significance index is 0.44, (See Appendix 5) which means that the finding does not have a significant evidence.

The beta and the Altman-Z correlation is also negative, accounting for -0.05, which is close to zero and it means that there is almost no correlation. It means that the more the risk that is coming from the market, the more is the probability of company's bankruptcy. However, the significance of this finding is questionable, as the significant index is 0.3. Moreover, the correlation rate is so relatively low, and it is possible to say that the systematic risk does not affect the probability of bankruptcy.

The correlation between Altman Z-score and the Standard Deviation is -0.210. It means that the more is the standard deviation, the less is the Altman Z. Consequently, it suggests that the more there are overall risks of the

company, the closer the company is to the bankruptcy. Since the likelihood of insolvency is not affected by the external risks, it means that the risk originates from the management itself.

Another significant finding that the correlation table is suggesting, that the Beneish M-score and the standard deviation correlate with the rate of 0.4. It means that in the end, the overall risks of the company do depend on the probability of bankruptcy more than on the market fluctuations. The significance index of this finding is zero, which means that the error is highly unlikely.

The Durbin-Watson test number is 1.7. (Appendix 6) It is a measure of the probability of error in the calculations, and this number should not exceed 2.5 and be lower than 1.5 (Glen, 2016). Since the generated number falls into the typical category, it is assumed that the reliability of the whole statistics calculations is high enough.

5 Discussion

5.1 Hypothesis development

In this chapter, the researchers aim to summarise all the hypothesises from the beginning of the work and compare them with the results that were generated during the data analysis process.

The primary objective of the work was to define the relationship between the accounting manipulations and the probability of bankruptcy, represented by the Beneish M-score and the Altman Z-score respectively. There were several possible outcomes.

The primary hypothesis of the researchers was that the management applies accounting manipulations for their own benefits, such as rewards, bonuses, additional profit and the tax avoidance. The assumption was built on the example of the Enron bankruptcy story. In this case, the illegal actions of management lead to the insolvency. In this case, there should be a negative correlation between the Beneish M-score and the Altman Z-score.

On the other hand, the same result could suggest, that when the company is suffering from the market instability and is already have problems with liquidity and investors' trust, it can apply the accounting manipulations to raise the foundation and survive. It is why the beta variable was introduced.

The beta measures the market affection of the company's stock. The researchers wanted to understand whether the risks are coming from the market and then the second assumption about the association between bankruptcy and manipulations would be more likely to be true. For the sake of making sure about the origins of the risk, the standard deviation has been introduced. Standard deviation is combining the systematic and unsystematic risks in one measure.

The sample of the companies examined in the study was carefully chosen from the public companies in the United Kingdom because its market within 2010 and 2015 did not have any crisis and English economy was experiencing blooming period.

In order to get the unbiased results, the companies have been taken from the different types of industries, and they all have different performance results. The performance result has been assessed by the stock price fluctuation within the period of time. It helps to have all possible motives for manipulations. Also, the study wants to examine if the performance of the company determines the probability of managers being manipulators.

The data analysis has been framed into two types of analysis representing different points of view. The company-based analysis is showing each case in particular. It is done to visualise the relationships between Altman Z and Beneish M score.

5.2 Main findings discussion

The researchers found it challenging to answer the central research question with this type of analysis, as 15 out of 18 companies had Altman's score less than its benchmark – they were all potential future bankrupts. However, it has been found that all of the companies that were potentially solvent and robust were from the retail industry. Furthermore, two of them were manipulators,

that supports the first idea of this thesis that there is a dependence between bankruptcy and the quality of annual accounts. Although, it proves that if the company applies accounting manipulations, its solvency is less likely.

Another interesting finding from the company-based analysis is that the most manipulative industry is technologies – five out of six technology companies in the sample appear to be manipulators.

Since the beta and the standard deviation numbers are too small to detect any fluctuation, any findings related to the second research question about the nature of the risks were impossible to answer through company-based analysis.

The statistics analysis examines the company's indicators regardless of its belonging to a particular type. The primary purpose of it was to find the numerical prove of the relationship between the Altman Z and Beneish M and the analysis of the risk origin.

There is no correlation between the two primary variables studied in this research, which means that there is no dependence of bankruptcy on the accounting manipulations. However, since the correlation rate is negative, it disproves the idea derived from the company-based analysis, that the more there are the accounting manipulations, the less is the probability of bankruptcy.

There was no correlation found between the Altman Z-score and the beta. It means that the market risks do not affect the likelihood of bankruptcy. Consequently, this risk is coming from the management itself.

There is a relationship between the Altman Z-score and the standard deviation. It proves that the risk affects the probability of insolvency. Even though it sounds logical, but in the context of all the findings and that the systematic risk has no significant affection, it proves that the main risk is the unsystematic one.

At the last stage of statistical analysis, the researchers have found, that there is a strong correlation between the standard deviation and the Beneish M-score. It means, that even though there is no significant relationship between

the bankruptcy, companies react on the internal risks with the accounting manipulations, which, in turns, affect the bankruptcy.

It is also essential to take into consideration the reverse casualty of this findings: it is not possible to say that it is the internal risks affect the probability of the company to be a manipulator and not the accounting manipulations that cause the internal risks.

5.3 Limitations of the research and suggested fields for studies

The literature review suggests that nowadays there are more accurate frameworks for the bankruptcy prediction and accounting manipulation detection. There is no universal opinion on the effectiveness of the Altman Z-score. It is why the results can be biased by the limitations of the chosen frameworks.

The researchers have decided to base their assumptions on this particular models because those are the fundamental systems in the approach and were well studied in the past.

The company-based analysis has not generated a robust assumption about the dependence of the frequency of accounting manipulations on the company's performance. It is not proved that the low-performing companies are more tend to manipulate accounts then the well-performers. It is possible that the sample of 18 companies was not enough.

The authors suggest that setting a more in-depth study of the dependence of bankruptcy on the accounting manipulations using more innovative models and more prominent company's sample. This proposal is due to the reason that there is a potential dependence because this work's findings detect the link between standard deviation.

Another suggestion could be investigating the cause of the phenomenon: is it the poor quality of annual reports that causes the internal risks or it is the riskiness of the company that requires "accounting kitchen"?

6 Conclusion

The central objective of this research was to find the correlation between the Altman Z-score and the Beneish M-score that would prove the dependence of bankruptcy on the accounting manipulations. The results show that there are no relations between these two phenomena.

There was a negative correlation found between the likelihood of bankruptcy and the standard deviation. Since there is almost no effect of the beta on the Altman Z-score, the researchers conclude that the risk that causes the probability of insolvency is unsystematic and coming from the management of the company.

The third objective of the research was to detect low-performing companies applying accounting manipulations more frequently than the others. According to the findings of this research, the low-performing company tends to manipulate the accounts as much as the well-performers. It is less likely that the high-performing companies are cooking its accounts.

Additionally, the study shows that the retail industry is safer than the food production and the technology industry regarding the probability of bankruptcy. The retail industry is also the most responsible and reports the lowest level of accounting manipulations.

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Appendices

Appendix 1. Beneish M, Altman Z, Beta and Standard Deviation output (Year-on-year basis) for each company in the sample.

A1									
Dunelm Group Plc					**WH Smith Plc**				
Year	Beneish M	Altman Z	Beta	Standard Deviation	Year	Beneish M	Altman Z	Beta	Standard Deviation
2010	-3,00591	4,713645	0,578584	0,02276931	2010	-2,96528	3,355195	0,436411	0,01410311
2011	-2,52222	4,132769	0,143302	0,021432663	2011	-3,85474	3,301114	0,196912	0,015166829
2012	-2,79546	3,951671	0,123203	0,017465825	2012	-2,97373	3,416923	0,158309	0,012983832
2013	-2,40923	4,746158	0,092116	0,016692051	2013	-2,90426	3,534076	0,13154	0,014640846
2014	-2,11376	4,740589	0,102779	0,015921722	2014	-2,62868	3,638653	0,12643	0,015506654
2015	-3,06263	4,576139	0,05747	0,014734916	2015	-2,6235	3,90933	0,107658	0,012131454
B1									
Associated British Foods Plc					**Cranswick Plc**				
Year	Beneish M	Altman Z	Beta	Standard Deviation	Year	Beneish M	Altman Z	Beta	Standard Deviation
2010	-2,82829	1,676968	0,498873	0,012936513	2010	-2,52077	2,742238	0,19013	0,017409676
2011	-2,38787	1,573721	0,179769	0,013103769	2011	-2,48904	2,825807	0,135937	0,017506452
2012	-2,79348	1,802787	0,135996	0,008912803	2012	-3,60176	2,831635	0,13353	0,013730582
2013	-2,77489	2,033244	0,105752	0,013436133	2013	-2,8002	3,041548	0,113431	0,01322476
2014	-2,93867	2,11874	0,11548	0,016123933	2014	-3,80551	2,87362	0,105199	0,014728609
2015	-3,77363	2,155742	0,09031	0,014616128	2015	-2,42335	3,089301	0,087431	0,013503913
C1									
E2V Technologies					**Halma Plc**				
Year	Beneish M	Altman Z	Beta	Standard Deviation	Year	Beneish M	Altman Z	Beta	Standard Deviation
2010	-2,72237	1,282478	-0,11919	0,033931584	2010	-2,64323	1,97575	0,592424	0,016085745
2011	-2,61771	2,145651	-0,17447	0,026822071	2011	-2,51446	1,831524	0,182627	0,016572251
2012	-2,23146	1,996889	-0,15005	0,025584163	2012	-2,24895	1,771075	0,11707	0,013439426
2013	-2,43934	2,212709	-0,11829	0,019905778	2013	-3,62884	2,214347	0,105865	0,011639521
2014	-2,95964	1,852637	-0,10159	0,014688401	2014	-2,18013	1,842718	0,094104	0,011443117
2015	-2,53605	2,132524	-0,10153	0,013852704	2015	-2,6735	1,604405	0,071189	0,011926099

A1									
Dunelm Group Plc					**WH Smith Plc**				
Year	Beneish M	Altman Z	Beta	Standard Deviation	Year	Beneish M	Altman Z	Beta	Standard Deviation
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2011	-2,52222	4,132769	0,143302	0,021432663	2011	-3,85474	3,301114	0,196912	0,015166829
2012	-2,79546	3,951671	0,123203	0,017465825	2012	-2,97373	3,416923	0,158309	0,012983832
2013	-2,40923	4,746158	0,092116	0,016692051	2013	-2,90426	3,534076	0,13154	0,014640846
2014	-2,11376	4,740589	0,102779	0,015921722	2014	-2,62868	3,638653	0,12643	0,015506654
2015	-3,06263	4,576139	0,05747	0,014734916	2015	-2,6235	3,90933	0,107658	0,012131454
B1									
Associated British Foods Plc					**Cranswick Plc**				
Year	Beneish M	Altman Z	Beta	Standard Deviation	Year	Beneish M	Altman Z	Beta	Standard Deviation
2010	-2,82829	1,676968	0,498873	0,012936513	2010	-2,52077	2,742238	0,19013	0,017409676
2011	-2,38787	1,573721	0,179769	0,013103769	2011	-2,48904	2,825807	0,135937	0,017506452
2012	-2,79348	1,802787	0,135996	0,008912803	2012	-3,60176	2,831635	0,13353	0,013730582
2013	-2,77489	2,033244	0,105752	0,013436133	2013	-2,8002	3,041548	0,113431	0,01322476
2014	-2,93867	2,11874	0,11548	0,016123933	2014	-3,80551	2,87362	0,105199	0,014728609
2015	-3,77363	2,155742	0,09031	0,014616128	2015	-2,42335	3,089301	0,087431	0,013503913
C1									
E2V Technologies					**Halma Plc**				
Year	Beneish M	Altman Z	Beta	Standard Deviation	Year	Beneish M	Altman Z	Beta	Standard Deviation
2010	-2,72237	1,282478	-0,11919	0,033931584	2010	-2,64323	1,97575	0,592424	0,016085745
2011	-2,61771	2,145651	-0,17447	0,026822071	2011	-2,51446	1,831524	0,182627	0,016572251
2012	-2,23146	1,996889	-0,15005	0,025584163	2012	-2,24895	1,771075	0,11707	0,013439426
2013	-2,43934	2,212709	-0,11829	0,019905778	2013	-3,62884	2,214347	0,105865	0,011639521
2014	-2,95964	1,852637	-0,10159	0,014688401	2014	-2,18013	1,842718	0,094104	0,011443117
2015	-2,53605	2,132524	-0,10153	0,013852704	2015	-2,6735	1,604405	0,071189	0,011926099

Appendix 2. Input data for Beneish-M score calculations for each company

A1							
Dunelm Group Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	10739	10470	14566	17054	18344	19479	19122
Sales	423783	492839	538474	603729	677192	730152	835805
Current Asets	92650	88422	126160	168465	156411	156747	168437
PPE	88771	102599	125850	146313	151060	152866	158946
Current Liabilities	74365	83383	98839	110693	115499	88945	100905
Long Term Debt	127	152	645	297	0	0	91000
Total Assets	187264	196223	256702	318016	313193	322656	342404
Net Income	37621	54350	59932	71475	81795	86454	98160
COGS	233628	262235	280125	311992	347448	368851	424649
SG&A	137560	155126	175051	196537	223206	245273	288672
Depreceation	8005	9494	12170	16233	20358	20257	21436
Cash Flow from Operattions	67444	71951	74025	91891	100399	103834	118195
WH Smith Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	57000	56000	57000	54000	51000	54000	52000
Sales	1340000	1312000	1273000	1243000	1186000	1161000	1178000
Current Asets	262000	285000	259000	246000	233000	235000	230000
PPE	163000	158000	151000	155000	149000	147000	155000
Current Liabilities	281000	300000	307000	305000	288000	294000	279000
Long Term Debt	8000	6000	6000	4000	2000	0	0
Total Assets	494000	513000	498000	483000	463000	457000	456000
Net Profit	51000	56000	58000	76000	82000	86000	137000
COGS	685000	650000	611000	579000	531000	502000	498000
SG&A	81000	80000	490000	567000	551000	72000	79000
Depreceation	41000	39000	38000	39000	37000	36000	38000
Cash Flow from Operattions	113000	104000	118000	115000	119000	116000	145000
B1							
Associated British Foods Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	1121000	1079000	1259000	1236000	1342000	1293000	1176000
Sales	9255000	10167000	11065000	12252000	13315000	12943000	12800000
Current Asets	3015000	2795000	3163000	3269000	3424000	3626000	3849000
PPE	3519000	3941000	4465000	4541000	4552000	4701000	4518000
Current Liabilities	2460000	2127000	2545000	2588000	2526000	2684000	2742000
Long Term Debt	1202000	1212000	1301000	1287000	1203000	858000	5997000
Total Assets	9033000	9288000	10202000	10267000	10374000	10412000	10219000
Net Profit	383000	569000	577000	583000	533000	552000	516000
COGS	7085000	7554000	8347000	9390000	10095000	9793000	881000
SG&A	1554000	1801000	1918000	2010000	2145000	2072000	2076000
Depreceation	372000	405000	330000	416000	535000	496000	408000
Cash Flow from Operattions	833000	1172000	736000	1240000	1276000	1439000	1175000
Cranswick Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	84066	78665	85534	93097	97775	116905	116799
Sales	740338	758422	820775	875171	994905	1003336	1016314
Current Asets	126211	116157	144846	149889	170967	181168	191370
PPE	106137	123262	130853	147386	156578	166087	178477
Current Liabilities	102890	95310	99027	113840	115628	125244	128331
Long Term Debt	59695	57776	49394	35519	33635	28884	6468
Total Assets	362587	377695	400157	149889	170967	493552	510058
Net Profit	32264	35968	34653	36973	39754	40852	45395
COGS	643535	657166	718605	768633	877012	878968	926869
SG&A	22347	20832	23076	21870	28643	27297	40714
Depreceation	11852	12440	13972	15486	17831	18349	21224
Cash Flow from Operattions	32204	51584	45533	49812	40759	54392	83834

C1							
E2V Technologies Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	51194	50006	45051	45208	58416	51454	55752
Sales	201247	228579	234615	200363	217745	224920	236423
Current Asets	116512	111212	114692	101938	114365	116688	134224
PPE	31336	31977	36616	38045	41079	43537	46869
Current Liabilities	74673	74860	61257	47773	53224	62265	55037
Long Term Debt	78100	46214	42791	24545	16554	30076	44332
Total Assets	265265	247399	239805	229378	238285	269095	305917
Net Profit	-2266	19492	23540	26737	25025	23756	29708
COGS	139999	142690	144634	122259	133854	128713	11256
SG&A	67285	55400	54775	42459	49649	65105	56092
Depreceation	10249	8937	7793	7806	7809	7465	8113
Cash Flow from Operattions	40633	31443	26593	22090	34752	40735	22527
Halma Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	98077	110456	114674	133605	135177	156464	183619
Sales	459118	518428	579883	619210	676506	726134	807805
Current Asets	177713	208170	218104	253366	241410	278517	344196
PPE	66786	69891	72118	76725	74417	86303	96562
Current Liabilities	76961	104253	108113	120623	1084116	129209	149330
Long Term Debt	35117	103957	90272	204063	148018	192281	388260
Total Assets	484150	624273	645183	849874	789624	942533	1264916
Net Profit	60437	72434	86714	93606	106327	104001	108841
COGS	310530	345841	384397	501931	532935	589071	589071
SG&A	64675	73138	85576	204209	210948	246199	246199
Depreceation	11461	11523	12178	12684	13625	14005	15245
Cash Flow from Operattions	100338	95064	97687	108244	121538	137231	149273
A2							
Kingfisher Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	494000	513000	531000	545000	590000	573000	568000
Sales	10503000	10450000	10831000	10573000	11125000	10966000	10441000
Current Asets	3381000	3095000	2989000	3068000	3407000	3517000	3392000
PPE	3612000	3632000	3667000	3748000	3625000	3203000	3212000
Current Liabilities	3430000	3125000	3050000	2870000	2790000	2747000	2648000
Long Term Debt	1080000	815000	644000	635000	251230	556000	512000
Total Assets	9846000	9603000	9633000	9897000	9820000	9713000	9694000
Net Profit	385000	491000	639000	564000	710000	573000	412000
COGS	6706000	6545000	4083000	6618000	7005000	6918000	6545000
SG&A	3248000	3275000	3338000	3319000	3431000	573867	3502000
Depreceation	1428000	1603000	1757000	1972000	2122000	2060000	2246000
Cash Flow from Operattions	1137000	630000	896000	601000	834000	660000	813000
Marks and Spenser Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	281400	250300	253000	245000	309500	321800	321100
Sales	9536600	9740300	9934300	10026800	10309700	10311400	10555400
Current Asets	1520200	1641700	1460100	1267900	1368500	1455000	1461400
PPE	4722000	4662200	4789900	5033700	5139900	5031100	5027100
Current Liabilities	1860500	2210200	2005400	2238300	2349300	2111600	2104800
Long Term Debt	2404500	2120600	2143800	1967900	1897700	2061200	2112300
Total Assets	7153200	7344100	7273300	7610700	7903000	8196100	8476400
Net Profit	523000	598600	489600	444800	506000	481700	404400
COGS	5918100	6015600	6179100	6230300	6439000	6325900	6427000
SG&A	614900	2959700	3021900	3110000	3224300	3304800	3412900
Depreceation	394200	416500	404800	374100	379700	400100	414100
Cash Flow from Operattions	1229000	1199900	1203000	1140200	1129600	1278000	1212000
B2							
Devro Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	28802	32791	34820	36300	33600	33700	35200
Sales	220405	213631	227723	241100	242700	232300	230200
Current Asets	65697	68923	71341	73643	80300	80100	76800
PPE	138071	157024	180215	195862	199100	230300	270100
Current Liabilities	34535	40761	40917	36017	34700	47700	46200
Long Term Debt	37771	29151	44734	48528	56700	94000	148000
Total Assets	237195	219015	273624	292524	297400	338900	384800
Net Profit	20219	42234	34192	32000	33600	4400	14600
COGS	154732	157321	142865	154866	157500	182300	164100
SG&A	13703	15369	16554	16600	19700	20600	23100
Depreceation	12300	12771	13906	15985	18000	23900	17600
Cash Flow from Operattions	41270	44985	38872	42787	42700	41600	34400

Tate & Lyle Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	424000	291000	332000	321000	256000	290000	301000
Sales	2533000	2720000	3088000	3256000	2754000	2356000	2355000
Current Asets	1509000	1626000	1389000	1151000	1062000	930000	1064000
PPE	1208000	855000	922000	812000	732000	750000	926000
Current Liabilities	878000	836000	676000	527000	706000	704000	650000
Long Term Debt	1178000	917000	830000	837000	479000	495000	577000
Total Assets	3288000	3051000	2906000	2716000	2468000	2423000	2554000
Net Profit	19000	167000	309000	273000	273000	30000	163000
COGS	2577000	2417000	2684000	2922000	2503000	2323000	2228000
SG&A	650000	596000	393000	429000	388000	475000	480000
Depreceation	99000	91000	85000	91000	83000	85000	80000
Cash Flow from Operattions	145000	587000	231000	251000	286000	179000	188000
			C2				
Univision Engineering Ltd	2009	2010	2011	2012	2013	2014	2015
Net Receivables	4400,341	14842,916	14643,264	15706,652	14299,649	4323,003	2460,855
Sales	6473,743	8576,363	7780,444	7313,425	8925,96	3675,494	3866,521
Current Asets	6255,232	16767,699	16238,976	17672,453	15962,439	7001,815	4312,344
PPE	197,093	108,864	109,766	25,83	25,83	47,629	42,629
Current Liabilities	8526,52	11399,074	9007,964	9752,682	6219,352	4406,804	2505,939
Long Term Debt	5,06	0,947	21,918	15,699	7,415	0,641	0
Total Assets	6478,155	17953,775	17714,965	19221,143	17356,486	10048,709	11035,891
Net Profit	-10348,258	8231,381	1747,025	184,405	2904,73	112,555	-340,609
COGS	4339,985	5209,729	5505,251	5060,805	6573,248	2613,541	2615,802
SG&A	1791,992	2094,328	1791,289	1802,837	1822,732	995,057	1057,162
Depreceation	55,043	82,498	78,402	65,904	49,086	14,605	16,546
Cash Flow from Operattions	1299,545	470,023	421,67	47,53	548,606	327,764	21,764
Spectris Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	164800	194800	220800	208800	215800	157700	182500
Sales	987300	901900	1106200	1230800	1202000	1173700	1190000
Current Asets	313400	391300	438600	439600	427100	444200	494500
PPE	107600	110500	152700	152500	159000	162500	160800
Current Liabilities	261900	273900	304200	368500	249800	298700	258400
Long Term Debt	96200	139400	417400	236500	184700	152600	196000
Total Assets	843900	973200	1362900	1331600	1308800	1406500	1459100
Net Profit	426000	96200	126300	140200	200000	135100	113800
COGS	342000	375000	457500	518000	504400	497300	506900
SG&A	292800	323500	384900	421400	414800	414900	440900
Depreceation	27400	28800	39800	47600	50500	47600	59000
Cash Flow from Operattions	101500	154400	169300	187200	152300	155200	153400
			A3				
Debenhams Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	68500	73400	72100	75400	78300	74700	78000
Sales	1915600	2119900	2209800	2229800	2282200	2312700	2322700
Current Asets	537100	447100	423600	459500	470500	486300	459700
PPE	669200	676100	634600	661600	692100	689200	675300
Current Liabilities	611500	1083600	715600	727000	741900	758000	695700
Long Term Debt	764200	124400	318700	314000	295000	277200	251900
Total Assets	2135800	2087300	2018200	2091200	2132800	2148400	2142600
Net Profit	95100	97000	117200	125300	115900	87200	93500
COGS	1650700	1838900	1913100	1927500	1982600	2033400	2023500
SG&A	82700	98100	113000	127300	144200	150700	165100
Depreceation	96000	94100	92000	91600	94600	100800	104200
Cash Flow from Operattions	158400	207200	1994400	201500	199300	206800	218100
Stanley Gibbons Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	9848	8866	9178	11668	14144	19604	15574
Sales	23365	26429	35704	35599	51772	60046	59137
Current Asets	22199	25478	29209	39162	65896	94452	81465
PPE	1103	1862	2032	2145	6294	7974	4916
Current Liabilities	4310	6151	7261	8536	18357	35082	35960
Long Term Debt	161	629	401	233	1288	11004	18565
Total Assets	23730	28386	33526	43994	107250	143756	107941
Net Profit	80	-113	4531	4766	2135	772	-29294
COGS	13454	14859	21872	20031	28937	29108	35304
SG&A	5891	7115	8787	10205	20481	28693	52152
Depreceation	122	202	351	439	982	1539	1913
Cash Flow from Operattions	4110	1784	3575	414	-4341	-8025	-6141

B3							
R.E.A. Holdings Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	8604	18057,06	21863,68	19614,55	17175	11724,02	19499,01
Sales	47331	71844,57	94565,12	76006	66328,2	57897,9	60645,05
Current Asets	29859,6	50008,14	58422,4	49114,76	48326,4	26629,86	39000,03
PPE	43354,8	53857,44	65398,4	88822,1	88198,8	69539,12	104280,14
Current Liabilities	14496,6	19063,8	23119,36	22688,95	37067,4	39673,16	54558,1
Long Term Debt	31738,8	37238,67	46707,84	62722,03	85572	66530,26	113739,2
Total Assets	223186,8	278855,64	326727,68	347096,1	360567,6	279996,02	437064,45
Net Profit	20038,8	19182,87	32682,88	9539,79	-9029,4	4599,54	2028,76
COGS	20370,6	30606,03	43555,84	38775,26	41940,6	35840,44	48512,02
SG&A	5122,2	7360,29	11953,92	12505	12149,4	8149,36	8575,33
Depreceation	2002,2	2339,82	3484,16	3681,35	5964	4715,92	7439,68
Cash Flow from Operattions	17786,4	13413,96	21616,64	19806,7	458,4	11220,32	13442,21
Premier Foods Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	347000	356300	297400	298600	248300	123500	100500
Sales	2529700	2438000	1999500	1756200	8562000	964300	771700
Current Asets	584700	901100	514800	550000	501500	237000	173300
PPE	635200	538600	417300	374200	196300	183300	187800
Current Liabilities	868800	995800	757200	691600	532400	267600	214100
Long Term Debt	1296700	1147900	1220600	1240900	818700	587600	541800
Total Assets	3699600	3499500	2611000	2387000	2059900	1913400	2083700
Net Profit	-309100	-82300	-422000	-172100	-390500	179300	307700
COGS	1771400	1690900	1445000	1261200	556100	630800	476200
SG&A	574500	655900	730100	394700	245400	377600	241000
Depreceation	123600	126500	113800	92900	61100	66100	53700
Cash Flow from Operattions	68300	1800500	-29100	4200	87500	3400	95400
C3							
Artilium Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	1887	1160	1126	2384	2946	2348	5263
Sales	6615	3183	6121	3477	11240	10150	7651
Current Asets	4241	2754	2165	3584	5935	2955	6035
PPE	450	323	189	146	99	420	354
Current Liabilities	4220	3959	3057	8341	7570	4240	6832
Long Term Debt	338	2504	39	828	657	497	555
Total Assets	16490	14291	13066	20310	22405	19014	22191
Net Profit	-13421	-3059	-2892	-3344	-235	170	-616
COGS	3074	1016	830	783	2977	2292	1882
SG&A	15090	6253	6441	5983	8688	7963	6561
Depreceation	856	745	584	252	803	609	596
Cash Flow from Operattions	-3429	-3002	-2173	-2077	2310	-1665	-623
Oxford Instruments Plc	2009	2010	2011	2012	2013	2014	2015
Net Receivables	57600	60200	52500	61000	71800	80900	87300
Sales	206500	211500	262300	337300	350800	360100	385500
Current Asets	111600	112400	125900	159100	171700	188100	189900
PPE	23500	22800	23600	28200	32900	34400	33100
Current Liabilities	84600	82900	88600	112600	118600	128600	144400
Long Term Debt	39400	26300	14600	7000	6200	153400	150200
Total Assets	201300	197400	208500	284700	321500	481600	474400
Net Profit	3100	-6400	44100	400	12200	6900	-7400
COGS	115800	120900	152800	190000	194500	200300	214500
SG&A	77600	75900	81400	93500	101900	112400	139600
Depreceation	8100	7900	8700	16000	8500	19700	27300
Cash Flow from Operattions	14400	31100	39200	50500	50400	21200	24800

Appendix 3. Input data for Altman Z-score calculations for each company

A1						
Dunelm Group Plc	2010	2011	2012	2013	2014	2015
Total Assets	196223	256702	318016	313193	322656	342404
Current Assets	88422	126160	168465	156411	156747	168437
Current Liabilities	83383	98839	110693	115499	88945	100905
Net Profit	54350	59835	71222	81454	89072	96071
Dividends paid	14029	17119	24248	29386	33411	41458
EBIT	75460	83298	95200	106538	116028	122484
Sales	492839	538474	603729	677192	730152	835805
Number of shares	201040,15	201490,108	202255,248	202830,188	202833,931	202833,931
Total Liabilities	83535	99484	110990	115499	132919	237336
Share prie	0,3989	0,47	0,5585	0,985	0,8315	0,895
WH Smith Plc	2010	2011	2012	2013	2014	2015
Total Assets	513000	498000	483000	463000	457000	456000
Current Assets	285000	259000	246000	233000	235000	230000
Current Liabilities	300000	307000	305000	288000	294000	279000
Net Profit	69000	73000	80000	87000	92000	101000
Dividends paid	26000	29000	31000	34000	38000	42000
EBIT	89000	93000	102000	107000	117000	124000
Sales	1312000	1273000	1243000	1186000	1161000	1178000
Number of shares	151000	139000	130000	123000	119000	115000
Total Liabilities	327000	404000	388000	361000	356000	309000
Share prie	0,4532	0,4937	0,6465	0,827	1,083	1,564
B1						
Associated British Foods Plc	2010	2011	2012	2013	2014	2015
Total Assets	9288000	10202000	10267000	10347000	10412000	10219000
Current Assets	2795000	3163000	3269000	3424000	3626000	3849000
Current Liabilities	2127000	2542000	2588000	2526000	2684000	2742000
Net Profit	569000	577000	873000	628000	783000	516000
Dividends paid	200000	212000	223000	232000	256000	271000
EBIT	819000	842000	873000	1088000	1080000	937000
Sales	10167000	11065000	12252000	13315000	12943000	12800000
Number of shares	791674	791674	791674	791674	791674	791674
Total Liabilities	3544000	6175000	4025000	3855000	3704000	3708000
Share prie	1,049	1,11	1,289	1,876	2,679	3,34
Cranswick Plc	2010	2011	2012	2013	2014	2015
Total Assets	377695	400157	426980	459254	493552	510058
Current Assets	116157	144846	149889	170967	181168	191370
Current Liabilities	95310	99027	113840	115628	125244	128331
Net Profit	35326	37480	36241	43207	41252	43395
Dividends paid	10508	11831	11404	12700	15350	14593
EBIT	48717	46736	50041	55782	53737	62709
Sales	758442	820775	875171	994905	1003336	1016314
Number of shares	47636,135	48034,791	48527,532	48961,889	49255,746	49844,854
Total Liabilities	156763	154225	153316	156543	161179	142055
Share prie	0,7535	0,805	1,057	1,197	1,424	2,144
C1						
E2V Technologies Plc	2010	2011	2012	2013	2014	2015
Total Assets	247399	239805	229328	238285	269095	305917
Current Assets	11212	114692	101938	114365	116688	134224
Current Liabilities	74860	31257	47773	53224	62265	55037
Net Profit	19492	23540	26729	25025	23756	29708
Dividends paid	0	10373	8729	9054	9746	11335
EBIT	30489	35206	35631	34242	31138	39075
Sales	228579	234615	200363	217745	224920	236423
Number of shares	214861,91	214946,456	218496,459	218780,046	219249,569	220187,058
Total Liabilities	126152	108369	77378	53573	99264	57816
Share prie	0,135	0,146	0,119	0,16675	0,23225	0,23225

Halma Plc	2010	2011	2012	2013	2014	2015
Total Assets	624273	645183	849874	789624	942533	1264916
Current Assets	208170	218104	253366	241410	278517	344196
Current Liabilities	104253	108113	120623	108416	219209	149330
Net Profit	72434	86714	95216	106327	104001	108841
Dividends paid	32891	35232	37765	40485	43399	46473
EBIT	99449	109910	118367	143571	137063	142643
Sales	518428	579883	619210	676506	726134	807805
Number of shares	378235,69	37855,028	378880,622	379018,522	379645,332	379645,332
Total Liabilities	268888	247071	396607	303624	393585	618576
Share prie	0,3735	0,4051	0,5005	0,5615	0,7125	0,892
A2						
Kingfisher Plc	2010	2011	2012	2013	2014	2015
Total Assets	9603000	9633000	9897000	9820000	9713000	9694000
Current Assets	3095000	2989000	3068000	3407000	3517000	3392000
Current Liabilities	3125000	3050000	2870000	2790000	2747000	2648000
Net Profit	491000	639000	564000	710000	573000	412000
Dividends paid	129000	178000	221000	224000	234000	232000
EBIT	698000	807000	692000	736000	652000	526000
Sales	10450000	10831000	10573000	11125000	10966000	10441000
Number of shares	2364000	2369000	2379000	2376000	2350000	2376000
Total Liabilities	4143000	3906000	3741000	3503000	3483000	3508000
Share prie	0,2544	0,2842	0,2697	0,394	0,3654	0,3343
Marks and Spenser Plc	2010	2011	2012	2013	2014	2015
Total Assets	7344100	7273300	7567700	7903000	8196100	8476400
Current Assets	1641700	1460100	1267900	1368500	1455000	1461400
Current Liabilities	2210200	2005400	2238300	2349300	2111600	2104800
Net Profit	598000	489600	458000	506000	481700	404400
Dividends paid	247500	267800	271300	273600	280700	301700
EBIT	836000	746500	756000	694500	701300	584100
Sales	9740300	9934300	10026800	10309700	10311400	10555400
Number of shares	1584863,9	1605507,102	1613888,192	1632247,974	1647814,75	1622964,807
Total Liabilities	4666700	4494500	5081300	5196300	4997300	5033000
Share prie	0,3614	0,325	0,4307	0,4252	0,536	0,892
B2						
Devro Plc	2010	2011	2012	2013	2014	2015
Total Assets	237195	273624	292524	297400	338900	384800
Current Assets	68923	71341	73643	80300	80100	76800
Current Liabilities	40761	40917	36017	34700	7200	46200
Net Profit	42234	34192	32000	33600	4400	14600
Dividends paid	9034	12227	13423	14200	14700	14700
EBIT	57072	42692	43248	42100	6400	19200
Sales	213631	227723	241100	242700	232300	230200
Number of shares	163609,01	165008,564	165633,564	166779,23	166921,042	166932,532
Total Liabilities	84195	133145	145598	139400	205700	257700
Share prie	0,2301	0,2662	0,341	0,3096	0,2815	0,299
Tate & Lyle Plc	2010	2011	2012	2013	2014	2015
Total Assets	3051000	2906000	2716000	2468000	2423000	2554000
Current Assets	1626000	1389000	1151000	1062000	930000	1064000
Current Liabilities	836000	676000	527000	706000	704000	650000
Net Profit	167000	309000	273000	273000	30000	163000
Dividends paid	70000	112000	119000	124000	130000	130000
EBIT	303000	404000	336000	251000	33000	127000
Sales	2720000	3088000	3256000	2754000	2341000	2355000
Number of shares	468111,34	468160,519	468192,9	468202,883	468223,975	468235,944
Total Liabilities	2078000	1848000	1751000	1418000	1487000	1525000
Share prie	0,9535	0,6925	0,8445	0,701	0,5965	0,588

C2						
Univision Engineering Ltd	2010	2011	2012	2013	2014	2015
Total Assets	17953,775	17714,965	19221,143	17356,486	10048,709	11035,891
Current Assets	16767,699	16238,976	17672,453	15962,439	7001,815	4312,344
Current Liabilities	11399,074	9007,964	9752,682	6219,352	4406,804	2505,939
Net Profit	8231,381	1747,025	184,405	2904,73	112,555	-340,609
Dividends paid	0	0	32,648	242,558	1,149	1,234
EBIT	8251,434	1762,725	241,683	2918,229	33,016	137,711
Sales	8576,363	7780,444	7313,425	8925,96	3675,494	3866,521
Number of shares	1697,617	1697,617	1697,617	1697,617	1697,617	1697,617
Total Liabilities	11400,021	9029,882	9752,682	6219,352	4407,445	5721,589
Share prie	0,0004	0,00043	0,00088	0,00082	0,00102	0,00068
Spectris Plc	2010	2011	2012	2013	2014	2015
Total Assets	973200	1362900	1331700	1308800	1406500	1459100
Current Assets	391300	438600	439600	427100	444200	494500
Current Liabilities	273900	304200	368500	249800	298700	258400
Net Profit	96200	126300	141300	200000	135100	113800
Dividends paid	28900	33800	45600	47700	52300	56900
EBIT	127900	175800	196500	185900	168300	143600
Sales	901900	1106200	1230800	1202000	1173700	1190000
Number of shares	125000	125000	125000	125000	125000	125000
Total Liabilities	459600	758700	640600	464700	490500	493100
Share prie	1,35	1,531	2,214	2,222	2,09	1,582
A3						
Debenhams Plc	2010	2011	2012	2013	2014	2015
Total Assets	2087300	2018200	2091200	6132800	2148400	2142600
Current Assets	447100	423600	459500	470500	486300	459700
Current Liabilities	1083600	715600	727000	741900	758000	695700
Net Profit	97000	117200	125300	127900	87200	93500
Dividends paid	0	12900	38500	41400	41700	41700
EBIT	189700	183700	175000	168000	128600	134100
Sales	2119900	2209800	2229800	2282200	2312700	2322700
Number of shares	1286806,3	1286806,299	1286806,299	1286843,441	1286843,44	1286852,54
Total Liabilities	1583900	1358600	1430200	1388400	1381000	829600
Share prie	0,0653	0,05635	0,1024	0,1022	0,0583	0,079
Stanley Gibbons Plc	2010	2011	2012	2013	2014	2015
Total Assets	28386	33018	47994	107250	143756	107941
Current Assets	25478	29209	39162	65896	94452	81465
Current Liabilities	6151	7261	8536	18357	35082	35960
Net Profit	-113	4531	4766	2135	772	-29294
Dividends paid	1322	1449	1581	1940	3385	824
EBIT	4287	5108	5363	2354	2245	-28319
Sales	26429	35704	35599	51772	60046	59137
Number of shares	25177,443	25262,311	28421,499	46597,859	47120,357	47120,357
Total Liabilities	7398	9189	12290	23305	76270	69549
Share prie	0,1735	0,1795	0,256	0,348	0,23685	0,01725
B3						
R.E.A. Holdings Plc	2010	2011	2012	2013	2014	2015
Total Assets	280745,64	326727,68	347096,1	360567,6	389559,68	437064,45
Current Assets	50008,14	58422,4	49114,76	48326,4	37050,24	39000,03
Current Liabilities	19063,8	23119,36	22688,95	37067,4	55197,44	54558,1
Net Profit	22032,99	29192,96	10798,83	7603,2	14067,84	3284,34
Dividends paid	3122,91	5057,92	6154,29	6618	7948,8	8461,43
EBIT	35448,21	46559,36	23087,28	16846,8	20554,24	11540,75
Sales	71844,57	94565,12	76006	66328,2	80553,6	60645,05
Number of shares	60478,226	77483,098	83414,545	87195,352	94638,001	100613,261
Total Liabilities	130478,04	132842,88	154927,8	180903	193319,68	228255,6
Share prie	0,75	0,6675	0,47113	0,4695	0,3265	0,265

Premier Foods Plc	2010	2011	2012	2013	2014	2015
Total Assets	3499500	2611000	2387000	20599000	1913400	2083700
Current Assets	901100	514800	550000	501500	237000	173300
Current Liabilities	995800	757200	691600	532400	267600	214100
Net Profit	-99300	-339000	12800	-245900	-123600	29200
Dividends paid	0	0	0	0	0	0
EBIT	93100	-176300	96300	52600	-44100	54500
Sales	2438000	1999500	1756200	856200	964300	771700
Number of shares	2398022,6	239805,802	239806,206			
Total Liabilities	2510000	2038300	1982100	2042000	1373200	1235200
Share prie	0,13954	0,07861	0,06125	0,09385	0,04625	0,039
C3						
Artilium Plc	2010	2011	2012	2013	2014	2015
Total Assets	14291	13066	20310	22405	19014	22191
Current Assets	2754	2165	3584	5935	2955	6035
Current Liabilities	3959	3057	8341	7570	2240	6832
Net Profit	-3059	-2892	-3344	-235	170	-616
Dividends paid	0	0	0	0	0	0
EBIT	-3913	-919	-3273	-337	78	-719
Sales	3183	6121	3477	11240	10150	9651
Number of shares	90446,964	143278,794	186706,349	216474,437	218925,385	236115,914
Total Liabilities	8878	3148	9190	8243	4737	7387
Share prie	0,0099	0,01013	0,00938	0,00813	0,00625	0,00625
Oxford Instruments Plc	2010	2011	2012	2013	2014	2015
Total Assets	197400	208500	284700	321500	481600	474400
Current Assets	112400	125900	159100	171700	188100	189900
Current Liabilities	82900	88600	112600	118600	128600	144400
Net Profit	13300	32200	24800	22000	18200	-6300
Dividends paid	4100	4100	4800	5600	6400	7100
EBIT	10200	27500	334700	33300	24000	3300
Sales	211500	262300	337300	350800	360100	385500
Number of shares	49567,328	50174,913	56166,723	56916,83	57250,835	57291,336
Total Liabilities	145200	115000	157600	183800	341400	348900
Share prie	0,28475	0,7455	1,224	1,54	1,289	0,93

Appendix 4. Descriptive statistics

	Mean	Std. Deviation	N
Altman	1,9433867	1,30371440	108
Beneish	-2,5299887	1,24965163	108
Beta	,1323564	,18996810	108
Standard Deviation	,0222	,01648	108

Appendix 5. Altman Z, Beneish M, Beta and Standard Deviation correlations

		Altman	Beneish	Beta	Standard Deviation
Pearson Correlation	Altman	1,000	-,014	-,050	-,210
	Beneish	-,014	1,000	,020	,417
	Beta	-,050	,020	1,000	,270
	Standard Deviation	-,210	,417	,270	1,000
Sig. (1-tailed)	Altman	.	,442	,304	,014
	Beneish	,442	.	,419	,000
	Beta	,304	,419	.	,002
	Standard Deviation	,014	,000	,002	.
N	Altman	108	108	108	108
	Beneish	108	108	108	108
	Beta	108	108	108	108
	Standard Deviation	108	108	108	108

Appendix 6. Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,226[a]	,051	,024	1,28815248	1,712

a. Predictors: (Constant), Standard Deviation, Beta, Beneish

b. Dependent Variable: Altman

Appendix 7. Coefficients.

.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	90,0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	2,613	,411		6,352	,000	1,930	3,295		
	Beneish	,095	,110	,091	,860	,392	-,088	,278	,817	1,224
	Beta	,114	,685	,017	,167	,868	-1,022	1,250	,917	1,091
	Standard Deviation	-20,009	8,684	-,253	-2,304	,023	-34,421	-5,597	,758	1,320

a. Dependent Variable: Altman